AUG 24 1921

Engineering Library

Printed on Thin Paper for Foreign Circulation.

The Engineer.

Established 1856. Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 33, NORFOLK ST., STRAND, LONDON, W.C. 2.

VOL. CXXXII.—No. 3423] LONDON: FRIDAY EVENING, AUGUST 5, 1921 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

Engineering Progress in July.

Modern Marine Diesel Engines—No. V.

The Ajax-Wyatt Electric Furnace.

Vegetable Oils for Internal Combustion Engines.

London's Electricity Supply Problem.

Spectroscopic Examination of Converter Flame.

A Comparison of Tramways.

Developments in Power Station Design. No III.

Hydraulic Power Regainers.

Midland Railway—New Dining Cars.

PUBLIC NOTICES

Finsbury Technical College,
LEONARD-STREET, CITY-ROAD, E.C. 2.
Dean for the Session 1921-22, Professor W. H. ECCLES, D.Sc., F.R.S.

The College provides for the Scientific Training of Students who desire to become Civil, Mechanical or Electrical Engineers or Chemists.

A certificate of proficiency is awarded by the Institute to students who satisfactorily complete a two years' course of instruction, and the Diploma of the College is awarded to students who attend a three years' course and who pass the prescribed Examinations with distinction.

Candidates are required to pass an Entrance Examination in Mathematics and English, but the Matriculation Certificate of any British University and certain other qualifications are accepted by the Institute in lieu of the Entrance Examination. The Entrance Examination for the Session 1921-22 will be held on Tuesday, September 20th next. Applications for admission should be forwarded to the College not later than the 15th September, on forms to be obtained from the REGISTRAR, Leonard street, City-road, E.C. The programme of the College is under revision and will be issued in due course. 5716

University of Birmingham.
DEPARTMENT OF METALLURGY.
Professor: THOMAS TURNER, M.Sc., A.R.S.M., F.I.C.
Lecturer: DOUGLAS H. INGALL, M.Sc.
Assistant Lecturers and Demonstrators: T. G. BAMFORD, M.Sc.
HAROLD HARRIS, B.Sc.

The course of study covers three years and leads to the Degree of B.Sc. in Metallurgy. There are separate courses for Metallurgists and Metallurgical Chemists. Special attention is devoted to Iron and Steel, Copper, Brass, and Local Industries, and to Preparation for Colonial and Foreign Posts.

Research and other Scholarships.

For particulars apply to
GEO. H. MORLEY,
5770 Secretary.

Leyton Higher Education Committee.
LEYTON TECHNICAL INSTITUTE.

WANTED, a WORKSHOP INSTRUCTOR at Leyton Technical Institute, Adelaide-road, Leyton, E. 10.

Commencing salary from £250 to £300, according to experience and qualifications.

Experience of modern engineering works in fitting, turning, grinding, &c., essential. Work in a modern tool-room, together with some teaching experience, an advantage.

Applications to be returned not later than 15th August.

For form of application send stamped addressed envelope to
R. J. GELDART,
Clerk to the Governors.
Town Hall, Leyton, E. 10. 5727

The University of Sheffield.
FACULTY OF ENGINEERING.

APPLICATIONS are INVITED for the POST of ASSISTANT LECTURER in MECHANICAL ENGINEERING.

Salary £400 per annum, including evening work during Winter Session. Candidates holding a University Degree with Honours in Mechanical Science preferred.

Applications, stating particulars of training and experience, accompanied by three testimonials, should be sent not later than August 20th to the undersigned.
W. M. GIBBONS,
5672 Registrar.

University of London, University College.

APPLICATIONS are INVITED for the POSITION of SENIOR ASSISTANT in the Department of Civil and Mechanical Engineering, which is under the direction of Professor E. G. Coker. The work requires training and experience in Engineering Design and Drawing-office practice.

Salary £450 to £500 (pensionable), according to qualifications and experience. Further particulars may be obtained from
WALTER W. SETON, M.A., D.Litt.,
Secretary.
University College, London
(Gower-street, W.C. 1). 5784

County Borough of Wallasey.
NEW BRIGHTON LANDING STAGE RECONSTRUCTION.

The Corporation of Wallasey invite TENDERS for the SUPPLY and DELIVERY of 12 CAST IRON COMPRESSORS with STEEL TIE RODS and PLATES for the attachment of Landing Stage Moorings for the above, in accordance with the detailed plans and specification prepared by Messrs. Wilton and Bell, Consulting Civil Engineers, Westminster Chambers, 1, Crosshall-street, Liverpool. Plans and specification may be seen at Messrs. Wilton and Bell's offices by appointment, and contractors desiring to obtain copies of the plans may do so on payment of £1 1s. Tenders, on the form of Tender provided, must be delivered to the undersigned in a sealed envelope, endorsed "Tender for New Brighton Landing Stage Compressors," not later than Noon, Saturday, September 17th, 1921.
GEO. LIVSEY,
Town Clerk.
Town Hall, Wallasey,
2nd August, 1921. 5792

County Borough of Wallasey.
SEACOMBE FERRY IMPROVEMENTS.

The Corporation of Wallasey invite TENDERS for the CARRYING OUT of that portion of the above work denominated Work "A," which comprises a NEW FLOATING GOODS LANDING STAGE, approximately 320ft. in length and 80ft. in breadth, and works in connection therewith, in accordance with the detailed plans and specification of Messrs. Wilton and Bell, Consulting Civil Engineers, Westminster Chambers, 1, Crosshall-street, Liverpool, the Engineers for the work, at whose offices copies of the plans and specification may be seen. Contractors desiring to obtain copies of plans and specification may do so on payment of £5 5s. Tenders, on the form of Tender provided, must be delivered to the undersigned in a sealed envelope, endorsed "Tender for Seacombe Ferry Improvements, Work "A,"" not later than Twelve Noon, Saturday, October 15th, 1921.
GEO. LIVSEY,
Town Clerk.
Town Hall, Wallasey,
2nd August, 1921. 5793

PUBLIC NOTICES

Bombay, Baroda, and Central India Railway Company.

The Directors are prepared to receive up to Noon on Wednesday, 24th August, TENDERS for the SUPPLY of—

CLASS A.
1. DUPLICATE PARTS for LOCOMOTIVES, CARRIAGES and WAGONS (Buffers and Brake Beams).
2. COPPER FIRE-BOX PLATES.
3. SCREW COUPLINGS.
4. HELICAL and VOLUTE SPRINGS.
5. LAMINATED and ELLIPTICAL SPRINGS.
6. SUPERHEATER ELEMENTS and FLUE TUBES.
7. STEEL BOILER TUBES.

CLASS B.
1. TYRES for LOCOMOTIVES.

CLASS C.
1. WIRE GAUZE.

Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment as follows:—

For Class A, 20s. each; Class B, 10s.; and for Class C, 5s. each (which will not be returned).

The Directors do not bind themselves to accept the lowest or any Tender.
S. G. S. YOUNG,
Secretary.
Offices: The White Mansion,
91, Petty France, Westminster, S.W. 1,
July 29th, 1921. 5785

East Indian Railway.

The East Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of—

(1) HELICAL AND VOLUTE SPRINGS.
(2) STEEL BOILER AND FLUE TUBES.

as per specification to be seen at the Company's offices.

Tenders are to be sent to the undersigned, marked "Tender for Helical Springs," or as the case may be, not later than Eleven o'clock a.m. on Wednesday, the 24th day of August instant.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each specification a fee of £1 1s. is charged, which cannot under any circumstances be returned.
By Order,
G. E. LILLIE,
Secretary.
Nicholas-lane, London, E.C. 4,
3rd August, 1921. 5809

The South Indian Railway Company, LIMITED.

The South Indian Railway Company, Limited, are prepared to receive TENDERS for the SUPPLY of:—
1. LAMINATED, VOLUTE, AND HELICAL SPRINGS.
2. BRUSHES.
3. RIVETS, NUTS, AND SPRINGS.
4. COPPER PLATES FOR LOCOMOTIVE FIRE-BOXES.

Specifications and forms of Tender may be obtained at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tenders for Laminated, Helical, and Volute Springs," or as the case may be, must be left with the undersigned not later than 3 p.m. on Wednesday, the 31st August, 1921.

A charge, which will not be returned, will be made of 20s. for each copy of Specification No. 1 and 10s. for each copy of Specifications Nos. 2, 3, and 4.

Copies of the drawings may be obtained at the office of Messrs. R. White and Partners, Consulting Engineers to the Company, 3, Victoria-street, Westminster, S.W. 1.
A. MUIRHEAD,
Managing Director.
91, Petty France, S.W. 1,
3rd August, 1921. 5819

PUBLIC NOTICES

Stone Urban District Council.
TO BORING CONTRACTORS.

The above Council invite TENDERS for SINKING a 21in. to 12in. BORE-HOLE, 500ft. deep, at their Waterworks.

Specification and form of Tender may be obtained from Mr. E. C. Frain, M.I.C.E., 39, Albion-street, Hanley, Stoke-on-Trent, on payment of £1, which will be returned on receipt of bona fide Tender.

Tenders, endorsed "Tender for Bore-hole," must be received by me, the undersigned, on or before Saturday, 20th August.

The Council do not bind themselves to accept the lowest or any Tender.
CHARLES H. MATTHEWS,
Clerk to the Council.
Westbridge House, Stone, Staffs,
30th July, 1921. 5776

For Immediate Sale, Two Horizontal Tandem Compound Condensing Steam Engines, built by the Glenfield Company, Kilmarnock, about 1895; cylinders 12in., 28in. dia., 27in. stroke, 160 lb. per sq. in. working pressure, 70 rev. p.m., 150 rated H.P. Expansion valves on both H.P. and L.P. cylinder, bayonet type frames. Engines can be run separately or coupled together by existing coupling.

Also FLY-WHEEL, 8ft. dia. by 16in. face, metallic packed piston-rod stuffing-boxes.

Also ONE SURFACE CONDENSER, approximately 220 sq. ft. surface, tubes 2in. external diameter.

Also SMALL PUMPS and C.I. STEAM PIPING, BELTS, &c.

The machinery is the property of the Grimsby Corporation and is in excellent condition.—Complete specification and permission to inspect can be obtained from H. GILBERT WHYATT, M. Inst. C.E., Borough Engineer, 170, Victoria-street, Grimsby. 5722

London County Council.

APPLICATIONS are INVITED for the APPOINTMENT of ASSISTANT DIVISIONAL OFFICER in the London Fire Brigade. Candidates must be of robust health, strong and active, and their ages must not be less than 25 and not more than 30 years. They must have had a good general education and must possess a sound knowledge of mechanical engineering. Experience in the control of men is essential.

The salary is £400 a year, rising by annual increments of £25 to £500 (based on pre-war conditions), with free quarters, uniform, coal, light, and medical attendance, such allowances being valued for the purpose of pension at £75 a year. The salary is subject to fluctuating temporary additions, making the commencing remuneration at present £747 12s. 3d. a year. The temporary additions are due for adjustment on 1st September, 1921, when a reduction will occur.

Preference will be given to candidates who have served or attempted to serve with H.M. Forces. Candidates who have not so served must be natural born British subjects.

Particulars and forms of application may be obtained from the Clerk of the Council, County Hall, Spring Gardens, S.W. 1, and must be returned to him not later than 11 a.m. on Monday, 12th September, 1921, endorsed "Assistant Divisional Officer, L.F.B." An addressed foolscap envelope bearing 2d. stamp must be sent with the request for form of application. Canvassing disqualifies.
JAMES BIRD,
5768 Clerk of the London County Council.

MISCELLANEOUS

IRON CASTINGS.—We Can Give IMMEDIATE DELIVERY of CASTINGS up to 3 tons each and machine same.—S. RICHARDS and CO., Ltd., Engineers, Lowestoft. 5754 I

PUBLIC NOTICES

Ministry of Public Works,
PHYSICAL DEPARTMENT.

APPLICATIONS are INVITED for TWO POSTS of INSTRUMENT MECHANIC at salaries of from £E288 plus 20 per cent. per annum to £E336 plus 20 per cent., according to qualifications, and such additional war gratuity as may be in force.

Candidates must have had experience in the repair of electrical instruments generally and X-ray apparatus in particular, or in the repair of calculating machines, such as the Hollerith tabulating machine and the Burroughs and Comptometer adding machines. Some knowledge of instrument design is also desirable.

The appointments will be on contract for a period of two years. An allowance for passage to and from Egypt will be made.

Further information can be obtained from the CONTROLLER, Physical Department, Cairo, to whom applications, together with testimonials and statements of qualifications, should be addressed before September 1st, 1921. 5719

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
WATER-TUBE BOILERS.

The Proprietors of British Letters PATENT No. 13,033/12 are PREPARED to SELL the PATENT or to LICENSE British manufacturers to work under it. It relates to water-tube boilers having several independent circulation tube sets which communicate with the water in the drum at different levels.
Address: BOULT, WADE and TENNANT,
111/112, Hatton-garden,
5773 I London, E.C. 1.

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
GEAR CUTTING APPARATUS.

The Proprietors of British Letters PATENT No. 18,659 of 1914 are PREPARED to SELL the PATENT or to LICENSE British manufacturers to work under it. It relates to machinery for cutting curved or so-called spiral teeth, particularly on bevel gears.
Address: BOULT, WADE and TENNANT,
111/112, Hatton-garden,
5774 I London, E.C. 1.

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
YARN WINDING MACHINES.

The Proprietors of British Patent No. 114,737 are PREPARED to SELL the PATENT or to LICENSE British manufacturers to work under it.

It relates to friction drive or drum winders for yarn, and comprises particularly improved stopping devices whereby quick arrest of the winding operation is ensured upon breakage or exhaustion of the supply yarns.
Address: BOULT, WADE and TENNANT,
111/112, Hatton-garden,
5775 I London, E.C. 1

SITUATIONS OPEN

WANTED, WORKS MANAGER for Engineering Works employing about 200 hands. Must be good practical man with sound technical training and organising ability, used to the control of men.—Address, stating age, salary required, and full details of training and experience, 5781, The Engineer Office. 5781 A

ASSISTANT QUANTITY SURVEYORS REQUIRED for important Argentine Railway. Must be fully qualified men and have articles duly endorsed. Unmarried preferred. Salary about £450.—Write, giving references and details of training and experience, to "SURVEYOR," c/o Street's, 30, Cornhill, London, E.C. 3. 5785 A

ENGINEER (Practical) WANTED, to Take Entire Charge of Boilers, Economisers, Quick-speed Engines, and Turbo Set, A.C. and D.C. Generators and Motors, Shafting, Gearing, &c., in a Large Textile Works. Should be a fair draughtsman and able to lay off buildings and heavy foundations. Ex-Service man preferred.—Address, stating age, experience, and salary expected, P3766, The Engineer Office. P3766 A

LONDON REPRESENTATIVE WANTED by a Firm of Constructional Engineers in the North, to secure orders for Pit Tubs, Light Railway Stock and Constructional Steel Work. To a suitable man the prospects are very good and a high salary and bonus will be paid. Reply should state in confidence age, experience, references, and suggested remuneration.—Box 286, Willing's, 125, Strand, W.C. 2. 5767 A

MACHINE TOOL SALESMAN REQUIRED; Must be capable of demonstrating and have minute knowledge and connection in definite district. Send details, salary expected, and experience. Knowledge of English and particularly American machines essential.—Address, 5718, The Engineer Office. 5718 A

SITUATIONS OPEN (continued) Page II.

SITUATIONS OPEN, Page II.
SITUATIONS WANTED Page II.
MACHINERY, &c., WANTED Page II.
FOR SALE Pages II., III. and VIII.
AUCTIONS, Pages IV. and CIV.
PREMISES TO LET OR WANTED, Page IV.
WORK WANTED, Page IV.
* AGENCIES, Page II.
MISCELLANEOUS, Page I.

For Advertisement Rates See Page 147, col. 1.

NUMERICAL INDEX TO ADVERTISEMENTS, Page CIII.

SITUATIONS OPEN (continued)

REPRESENTATIVE WANTED by Old-established Yorkshire firm. State experience, ground covered and full particulars. Good salary and commission to right man. First-class influence and connection with steel works, collieries, and large steam users absolutely essential.—Address, 5814, The Engineer Office. 5814 A

REQUIRED for Large Firm of Constructing Engineers in Spain, SEVERAL experienced LOCOMOTIVE DRAUGHTSMEN, single men preferred. State age, previous engagements, with length of service, and details of work carried out, giving copies of references and salary required. Knowledge of Spanish or French desirable.—Box S. 770, c/o Dawson's Advtg. Agency, 121, Cannon-street, E.C. 4. 5812 A

YOUNG MECHANICAL ENGINEER, who has had good technical college education and actual workshop training of a general character, is REQUIRED for Research Work with Mechanical Engineers. Only applications stating fully detailed particulars of training, career, age, and salary will be considered.—Address, 5813, The Engineer Office. 5813 A

INDIA.—DRAUGHTSMAN REQUIRED by a European firm of Bridge and Steel Structural Engineers; must be able to make complete working drawings for all types of Structural Steel Buildings, Plate and Lattice Girder Bridges, &c., and work out simple calculations of stresses and strains. Age 23 to 25, bachelor.—Reply, giving full particulars, Z. D. 290, c/o Deacon's, Leadenhall-street, London. 5808 A

DRAUGHTSMAN REQUIRED for Structural Work in London office. Wages £5 10s. to £6 per week.—Address, 5806, The Engineer Office, stating age and what experience. 5806 A

WANTED IMMEDIATELY, FOREMAN, Used to Aerial Rope Traction, for appointment abroad.—Address, 5817, The Engineer Office. 5817 A

SITUATIONS WANTED

ADVERTISER, Englishman, 54 Years of Age, with knowledge of engineering work, is PREPARED to SUPERINTEND or RENDER SERVICEABLE ATTENDANCE to Gentleman or Directors. Time arranged as desired for fair remuneration. 'Phone East 1540.—JOHN SMITH, 50, Bath-street, Poplar, London, E. 14. P3759 B

BUYER of WORKS SUPPLIES, Now Terminating important engagement, is DESIRING NEW APPOINTMENT; expert knowledge markets for materials, small tool, machinery. Keen organiser and departmental administrator.—Write, Z. Y. 292, c/o Deacon's, Leadenhall-street, E.C. 3. 5787 B

CIVIL ENGINEER, in Private Practice, DESIRES to PLACE his SON with a Corporate Member of the Institution of Civil Engineers as PUPIL. Railways, Bridges or Harbour Works.—Address in first instance, P3723, The Engineer Office. P3723 B

ENGINEER (34), Having Successfully Completed contract out East and returned home, DESIRES to NEGOTIATE NEW APPOINTMENT with firm requiring an up-to-date energetic engineer; first-class general experience works and D.O.; good organising ability, quick designer, accustomed to obtaining best results in shops and supervising erection and testing plant and machinery of any capacity.—Address, P3778, The Engineer Office. P3778 B

ENGINEER, Age 36, Married, 1st Class B.O.T. certificate, 6 years' experience modern merchant steamships, oil fuel, electricity, refrigeration, NH3 and CO2 systems; 3 years engineer and works manager of factory, making out own plans and specifications for new work, installing plant and machinery; 4½ years' war service as Temporary Engineer-Lieutenant, Royal Navy, in charge of workshops and repairs to Auxiliary Patrol vessels; sailed as chief engineer; successful with all degrees of labour; DESIRES POSITION in England, with prospects, where above experience would be of service. Excellent references.—Address, P3757, The Engineer Office. P3757 B

ENGINEER OPEN for ENGAGEMENT Either at home or abroad. Extensive experience steam and electrical plant, also building construction. Nine years general manager large concern in the East; 1st class B.O.T. certificate; good organiser and used to the control of staff and labour.—Address, P3764, The Engineer Office. P3764 B

ENGINEER SHORTLY OPEN FOR RE-ENGAGEMENT, home or abroad. Apprenticeship, Denny's; good experience, turbines, paddle and stern-wheel engines.

Three years R.M.S.P. Co.; considerable experience hydraulic and refrigerating machinery; extra-chief engineer's B.O.T. Certificate, London; four years Rand; large experience turbo-generators, stamp batteries, cyanide plants, air compressors, electric motors all sizes and types, multi-stage centrifugal pumps, steam and electric hoists, transformers, &c. &c.; resident engineers' Certificate for Union of South Africa; four years constructing and maintaining Bucyrus steam shovels, locomotives, blowing engines, washing plants and concentrators of all sizes, water turbines, Babcock and Wilcox, Stirling, Smulders, Rumboldt and Marshall boilers, fitting, boiler, machine and moulding shops in Katanga.

WAR SERVICE.—1914: Temp. Eng.-Lieut. R.N. H.M.S. New Zealand, Battle-cruiser. 1915: Staff, Captain-Superintendent Clyde district; large experience constructing warship machinery. 1916: Chief Engineer, H.M.S. Napia. 1917: Promoted Eng.-Lieut.-Commander R.N.; Chief Engineer, H.M.S. Contest. 1918: Commanding Officer, Royal Naval Experimental Section, Admiralty.

At present mechanical and electrical engineer large group of mines, Katanga, Africa. Knowledge French; good draughtsman, excellent disciplinarian with foreign labour; superior London and African references; Scotch; non-smoker, temperate, robust constitution, hustler, age 35, married; £80 to £100 per month expected.

Address, 5365, The Engineer Office. 5365 B

ENGINEER, Speaking FIVE LANGUAGES, with 15 years' experience, England and Continent, SEEKS POSITION, foreign representative, technical or commercial. Highest testimonials. Specialised lately in OIL BURNERS. ARGENTINE preferred.—Address, P3781, The Engineer Office. P3781 B

ERECTING ENGINEER, 25 Years' Exp. Erection of colliery, coke oven, chemical and general engineering plant, constructional steel work, &c., OPEN for ENGAGEMENT; highest ref., moderate salary.—Address, P3772, The Engineer Office. P3772 B

HARDENER SEEKS POSITION, Possessing a practical and theoretical knowledge of hardening high-speed, carbon, and alloy steels, also carbonising; 10 years' experience on gas, oil, and electric furnaces at home and abroad.—Address, "CARBON," c/o Wm. Porteous and Co., 9, Royal Exchange-place, Glasgow. P3763 B

MECH. MINING ENGINEER, Presently at Work in Br. Guiana, is OPEN for ENGAGEMENT in October; wants responsible position. Has over 20 years' experience, alluvial, quarts, hydr. mining and dredging in N. and S. Am.—Address, P3727, The Engineer Office. P3727 B

THE GUARDIANS are DESIROUS of APPRENTICING a sharp BOY, aged 14 years, in some engineering works. Offers invited.—Addressed to T. LOUIS COLLARD, Clerk to the Guardians, Bridge Union, Canterbury. 5794 B

WANT Home or Abroad POSITION as MECHANICAL or CIVIL ENGINEER; surveying, lay-out, erection, maintenance, steam, water power, all branches and general; own instruments; energetic; 31, single; good refs.—Address, P3675, The Engineer Office. P3675 B

SITUATIONS WANTED (continued)

£100,000 CLEAR PROFIT.—COMMERCIAL ENGINEER, having marketed the surplus stores of materials and small tools at the largest English engineering works, is OPEN to ACCEPT immediate new APPOINTMENT.—Write, Z. A. 287, c/o Deacon's, Leadenhall-street, E.C. 3. 5807 B

DRAUGHTSMAN DESIRES POSITION in London; good all-round, very neat and quick, also good leveller and surveyor.—Address, 5797, The Engineer Office. 5797 B

DRAUGHTSMAN (30), 14 Years' Exp., Works and D.O., power plant, mechanical handling plants, mining plant; very accurate.—Address, P3779, The Engineer Office. P3779 B

DRAUGHTSMAN (40) DESIRES BERTH: 5 Years shops, 20 years D.O., general experience, 6 years leading draughtsman; London district preferred.—Address, P3770, The Engineer Office. P3770 B

DRAUGHTSMAN.—8 shops, 2½ Years; Machine shop, fitting and erecting and Pattern shop, drawing-office, 8½ years; steam and internal combustion engines, 6½ years; large aeroplanes and seaplanes (D.O.), 4½ years.—Address, P3776, The Engineer Office. P3776 B

ENGINEER and DRAUGHTSMAN, Wide Experience of hydraulics, furnaces, structural, pumps, cranes, lay-outs. Temporary or permanent.—Address, P3760, The Engineer Office. P3760 B

JUNIOR DRAUGHTSMAN (21) DESIRES CHANGE; 3½ years shops and D.O.—T. J. D., 30, Dagnan-road, Balham, S.W. 12. P3773 B

LADY TRACER, Fully Experienced, REQUIRES SITUATION or PRIVATE TRACINGS. Lowest charges.—Apply by letter, Miss JONES, 20, Wellington-street, Strand. P3765 B

LADY TRACER, Thoroughly Experienced in Engineering tracing, SEEKS FULL-TIME EMPLOYMENT at home.—Address, P3777, The Engineer Office. P3777 B

MECHANICAL DRAUGHTSMAN, with Wide Experience in the design and lay-out of various industrial plants, power station design, &c., DESIRES SITUATION, City office preferred.—Address, P3762, The Engineer Office. P3762 B

FOREMAN MANAGER of FORGING SHOPS, expert on drop forgings, dies and heat treatment, capable of rate fixing and estimating, DESIRES CHANGE; £500-£600.—Address, P3724, The Engineer Office. P3724 B

MACHINE SHOP FOREMAN (37), Disengaged, DESIRES POSITION. Marine, hydraulic, crane, and general engine experience.—Address, P3767, The Engineer Office. P3767 B

SMITHY and FORGE FOREMAN; 12 Years Foreman, marine and general engineering, forging presses, heat treatment, fixing piecework prices, technical training, advanced methods, tactful.—Address, P3758, The Engineer Office. P3758 B

WANTED, POST of CHARGE HAND Over Large or small tracing office; work passed through with dispatch and efficiency. Disciplinarian, good organiser.—Address, P3771, The Engineer Office. P3771 B

MILLWRIGHT (Wood or Iron) SEEKS JOB. Upkeep of plant or erection of new; good refs. and experience.—W. S., c/o Home Cottage, Vange, Pitsea, Essex. P3780 B

PLATER, Used to Tank and Constructional Work, able to estimate workshop costs, DESIRES POSITION as ASSISTANT FOREMAN or CHARGE HAND. First-class workman.—Address, P3766, The Engineer Office. P3766 B

PARTNERSHIPS

ENGINEERING PARTNERSHIPS AND BUSINESSES.

Wheatley Kirk, Price & Co.
46, Watling Street, London, E.C. 4.

Established seventy years.

ENGINEERING CONCERN, North of England, Well established, with valuable connections at home and abroad, making electrical speciality machines in good demand amongst manufacturers, DESIRES FIND DIRECTOR, with or without employment, to replace old proprietor, retiring; £5000 to £10,000 capital required. Every investigation courted.—For particulars write, Box 146, Bradford Advertising Agency, 12, Market-street, Bradford, Yorks. 5795 C

EDUCATIONAL

CORRESPONDENCE COURSES for B.Sc., Inst.C.E., I. Mech. E., and all ENGINEERING EXAMINATIONS. Special Courses and Single Subjects. Personal Tuition.—Mr. TREVOR W. PHILLIPS, B.Sc. (Hons.), Assoc. M. Inst. C.E., M.E.S.I., &c., 9-10, Trafford Chambers, 58, South John-street, Liverpool. Ex

INST. C.E., Inst. Mech. E., B.Sc., and all ENGINEERING EXAMINATIONS.—Mr. G. P. KNOWLES, M.B.E., B.Sc., A.M. Inst. C.E., &c., personally PREPARES CANDIDATES, either orally or by correspondence. Hundreds of successes during the past twelve years. Courses can be commenced at any time.—39, Victoria-street, Westminster, S.W. Telephone No. Victoria 4780. Ex.

LEARN SURVEYING AND LEVELLING.—Thorough practical instruction given by an expert.—Address, E. MOUL (late L.S.W. and S.P.D. Rlys.), Hollybank, Woking. P3693 E

The Tutorial Technical Association, Architecture and Building, Engineering, Surveying, and Auctioneering, PREPARES CANDIDATES for the EXAMINATIONS of INST. C.E., INST. MECH. E., INST. E.E., INST. MUN. and CY. E., SURVEYORS' INSTITUTION, &c.

Studies arranged and conducted either by correspondence, in class or personally, by W. R. E. HONNER, M. Eng., A.M. Inst. C.E. (Engineering); J. B. KNOWLES, F.S.I. (Surveying and Auctioneering and Agricultural Subjects); E. GODFREY PAGE, A.R.I.B.A. (Architecture, &c.).

Practical experience. Individual attention. Moderate fees.

Write to Lieut.-Col. H. W. HAMLETT (Business Director), The Tutorial Technical Association, 7, Harpur-street, London, W.C. 1. Telephone, Museum 6715. 5371

TUITION BY POST.—Inst. C.E. and I. Mech. E. Enrol now for next Exams.; 100 per cent. Passes last examination. Estab. 1876.—PENNINGTONS, University Tutors, 254, Oxford-road, Manchester. Ex.

AGENCIES

AGENTS WANTED for New Patent HOIST BLOCK, "THE COMPACT," and various kinds of Hoisting Tackle, Electric Hoist Blocks, &c.—"SADACS" COMPANY. Office: 70, Avenue Eugene Demolder, Brussels (Belgium). Works: Avenue Emanuel, Haren-Nord, Brussels. 5624 D

CHINA AND THE FAR EAST.

WELL-KNOWN ENGINEER, with Great experience and valuable business connections in the Far East, is shortly proceeding to China on a special mission. He is PREPARED to ACT for an ENGINEERING FIRM or GROUP of FIRMS in establishing or reorganising their business arrangements in China and other countries in the Far East.—Address, 5804, The Engineer Office. 5804 D

MANUFACTURERS Desirous of Extending their connections should apply to the MANUFACTURERS' AGENTS ASSOCIATION of Great Britain and Ireland, 90-91, Queen-street, Cheapside, E.C. 4. Branches in Manchester, Scotland and Ireland. Classified lists of agents representing manufactured goods and covering all principal trade centres. MANUFACTURERS' AGENTS who are not yet members should apply for copy of twelfth annual report. Only established agents eligible. Subscription one guinea per annum. Ex. D

REPRESENTATION IN FRANCE.

AN ENGINEER, Who Has Successfully negotiated difficult engineering contracts in France and has lived many years in that country, is OPEN to REPRESENT a few BRITISH MANUFACTURING ENGINEERS in Paris. He is now in England.
Address, 5805, The Engineer Office. 5805 D

MACHINERY, &c., WANTED

WANTED, a SET of Motor or Belt-driven SCRAP CUTTING SHEARS with large opening, to cut 1in. thick.—Address, 5755, The Engineer Office. 5753 F

WANTED, HAMMERING MACHINE for PISTON RINGS. State lowest price and where can be seen.—Address, P3775, The Engineer Office. P3775 F

WANTED, PLATE BENDING ROLLS, Suitable for plates up to 3-8in. thick by 8ft. long by 12in. dia. or near. Must be in good condition.—Address, 5706, The Engineer Office. 5706 F

WANTED, ONE SECOND-HAND FACE-PLATE LATHE, suitable for swinging 13ft. to 16ft. diameter, belt driven or alternatively motor driven. State where same can be inspected.—Apply, HEENAN and FROUDE, Ltd., Worcester. 5795 F

WANTED, SECOND-HAND MASSEY PNEUMATIC or BELT-DRIVEN HAMMER. 1-1½ cwt.
Address, 5574, The Engineer Office. 5574 F

WANTED, SECOND-HAND POWER PRESS in good condition, having a maximum pressure of 150 tons.
Address, giving lowest price f.o.r. and full particulars, 5791, The Engineer Office. 5791 F

FOR SALE

A TIME RECORDER, as New, Guaranteed. Latest model. What offers?—A. F. PELLEY, 149, Farringdon-road, E.C. 1. Ex.

COMPLETE PLANT FOR IMMEDIATE DISPOSAL.

Comprising

THREE 500 K.W. BELLISS-WESTINGHOUSE A.C. SETS

5500 Volts, 25 Cycle, 3 Phase, 250 r.p.m., Steam Pressure 185 lbs., Superheat 100 deg., with Surface Condenser having 4200 sq. ft. Cooling Surface, Edwards Air Pump, Baker Oil Separator with Exhaust Piping, Platforms, Rails, Ladders, etc.

This Plant is equal to New, having done very little work and is open to any Expert Examination at Birmingham. It will be sold separately if desired, or the Engines (which are Standard 600 K.W. at 300 r.p.m.) by themselves. They are Triple Expansion Type, Cylinders 17, 24½ and 37½ by 18in. stroke.

Also Three Babcock Wilcox BOILERS, 20,000 lbs. Evaporation each, fitted with Superheaters and Chain Grate Stokers, insured at 185 lbs.

The whole of the above is ready for Immediate Delivery, and a low price will be accepted for a quick clearance, as the room it occupies is wanted very urgently for the installation of larger plant.

Customers to dismantle at their own expense, but arrangements might be made for this to be done for them.

Apply

FRANK GILMAN,
9, Westfield Road, BIRMINGHAM.
5788 G

CRANES & STEAM NAVVIES.

ONE 20-Ton Crane Type STEAM NAVVY, by Wilson, 30ft. jib, weight about 70 tons. A very powerful machine of modern type.

ONE "Lusbecker" STEAM NAVVY or EXCAVATOR, "C" type. Large machine and very powerful.

ONE "Bucyrus" STEAM NAVVY, 3 yards capacity, on eight wheels, late type.

ONE Heavy "Atlantic" Type STEAM NAVVY, rebuilt 1918, weight 70 tons.

TWO 12-Ton "Wilson" Crane Type NAVVIES, swan neck jibs. Excellent condition.

FOUR 10 H.P. "Ruston" Tower Type NAVVIES.

TWO PILING FRAMES and QUANTITY of STEEL PILING.

ONE 15-Ton Main Line Steam BREAKDOWN CRANE, by Cowans-Sheldon, eight wheels, 24ft. jib, completed with guard irons and vacuum brake connections, standard gauge. A fine crane.

ONE "Lusbecker" STEAM NAVVY or EXCAVATOR, "B" type, cutting face 42ft., 90 H.P. engines, boiler for 100 lb. w.p., capacity about 2000 yards per day. A fine machine.

ONE New 5-Ton STEAM LOCO. CRANE, 4ft. 8½in., all motions, 30ft. steel jib. Excellent design.

SEVEN ELECTRIC LOCO. CRANES, 4ft. 8½in. and 7ft. gauges, by Smith of Rodley, to lift 7 tons at 14ft. radius, steel lattice jibs, direct-coupled motors, 500 volts D.C. These cranes are in almost new condition and ready for immediate delivery.

ONE 25-Ton ELECTRIC OVERHEAD CRANE, 28ft. span.

TWO 6-Ton HYDRAULIC GANTRY CRANES, by Tannett-Walker, steel jibs, 26ft. radius.

Full specifications, prices, &c., on application to—

JOHN F. WAKE,
DARLINGTON. 5810 G

FOR SALE

MACHINERY FOR SALE.

Turbo Generators, A.C. and D.C.

ONE 1500 K.W. British Westinghouse, mixed pressure, 440 volts, 50-period, 3-phase, built 1915, with Rotarbo electrically-driven Jet Condenser.

TWO 1000 K.W. Willans-Parsons E.C.C., 6600 or 3300-volt, 50-period, 3-phase, with surface condensing plant complete.

TWO 1000 K.W., 3300 volts, 50-period, 3-phase, with surface condensers.

THREE 1000 K.W. Exhaust Steam, 440 volt D.C.

ONE 800 K.W. Willans-Siemens, 6600 volts, 50-period, 3-phase.

ONE 750 K.W., 525-volt, 50-period, 3-phase, makers A.E.G. Company, with surface condenser.

ONE 600 K.W. Mixed-pressure Parsons-Siemens, 220-volt D.C.

ONE 500 K.W. Westinghouse Impulse Reaction type, 440 volts D.C.

ONE 400 K.W. Westinghouse-Parsons, 440 volts D.C.

TWO 100 K.W. Turbos, 440 volts, 50-period, 3-phase, B.T.H.

SWITCHBOARD (brand new), for 460/550 volts, 50-period, 3-phase, by B.T.H. Co., 33ft. long, all complete with latest type instruments; cost £1800; all packed in 21 cases ready for despatch; price £950 f.o.r.

Generating Sets, D.C. and A.C.

THREE 500 K.W. Belliss Westinghouse 5500 volt, 25-period, 3-phase, and Surface Condensers, the whole forming a complete plant. Immediate delivery can be given.

ONE 300 K.W. and TWO 200 K.W. Diesel Dick-Kerr, 2000 volts, 50-period, 2-phase.

ONE 250 K.W. Belliss-Silvertown, 440/500 volts.

THREE 200 K.W. Belliss-Siemens, 3300-volt, 50-period, 3-phase.

ONE 200 K.W. Allen, 250 volts, shunt interpole.

ONE 155 K.W. Belliss-Parker, 125-volt.

FOUR 150 K.W. Belliss-Houston, 220-volt, with surface condenser.

ONE 500 K.W., 220-volt, low-pressure TURBINE, for running on exhaust from the above four 150 K.W. sets, complete with Le Blanc Multiple-jet Condenser, also switchboard, piping, connections and spares; will sell as a complete plant or separately.

ONE 75 K.W. Belliss-Bouverie, 250-volt, 50-period, 3-phase.

ONE 55 K.W. Hargreaves, 110-volt.

ONE Brand New Generating Set, comprising 200 H.P., 4-cylinder National Gas Engine, coupled to 200 K.W. Mather and Platt 440-volt D.C. Generator, with suction plant complete.

Motors, 440 and 220 Volts, D.C. and A.C.

Large number in stock for immediate delivery from 250 H.P. down to 1 H.P. Inquiries solicited.

Lancashire Boilers, etc.

ONE 30ft. by 9ft., insured 160 lb.
THREE 30ft. by 8ft. 6in., 160 lb.
TWO 30ft. by 8ft., insured 160 lb.
THREE 30ft. by 8ft., 120 lb.
FOUR 29ft. by 7ft. 6in., insured 80 lb.
TWO 28ft. by 7ft. 6in., 150 lb.
TEN 26ft. by 7ft., comprising eight Galloway patent and two Lancashire type, each with best fittings, including Hodgkinson's patent stokers, superheaters, dampers, &c. &c., insured 100 lb. pressure.
ONE 20ft. by 8ft. Cornish, 80 lb.
ONE Babcock Boiler, 21,000 lb. per hour, insured 160 lb., with superheaters and chain grate stokers.
TWO Ditto, 20,000 lb. per hour.

Economisers.

288-tube Green's ECONOMISER, comprising three sections of 96 pipes per section, insured 200 lb.
THREE 128-tube Green's Patent ECONOMISERS, insured 160 lb., new 1916.
ONE 234 Ditto, ditto, ditto.
All complete with fittings ready for loading.

Pumps.

ONE Clarke-Chapman Vertical Tandem Compound Woodeson Patent BOILER FEED PUMP, capacity 2500 gallons per hour against a pressure of 200 lb., just thoroughly overhauled.
ONE Gwynne 14in. CENTRIFUGAL PUMP, 3000 gallons per hour, 40ft. head, 350 r.p.m.
TWO New Weir, 5000 gallons, at 175 lb.

Locomotives, Cranes, and Navvies.

TWO New 15in. "Avonside" 6-wheeled coupled, 170 lb. pressure, fitted with Kermodes oil-burning installation, arranged to work with either oil or coal fire.
ONE 14in., 4-wheeled coupled, insured 140 lb.
ONE 12in., 6-wheeled coupled Locomotive, wheels 2ft. diam., wheel base 10ft., insured 140 lb.
ONE 12in., 4-wheeled coupled Hunslet, just entirely rebuilt, insured 140 lb.
ONE 10-ton Smith Loco. Shunting Crane, in excellent condition; ready for despatch.

Air Compressors.

TWO 2-stage, 2-crank Bellies, 500 cubic feet capacity, 60 lb. pressure, direct coupled to 85 B.H.P. Mavor, 225-volt D.C. Motor.
ONE Steam-driven AIR COMPRESSOR, by Tilghman, capacity 300 cubic feet per minute.
ONE Single-stage Alley, capacity 50 cubic feet, 60/85 lb. pressure, coupled direct to 12 H.P., 220-volt D.C. Lancashire Motor.

FRANK GILMAN,
9, Westfield Road, Birmingham.
Tel. Address: Rotherwood, Birmingham.
'Phone: 1081 Edgbaston.

CONDENSING PLANTS (TWO), Contraflo Surface Type, by Richardsons-Westgarth, capacity each 24,000 lb. steam per hour, condition absolutely as new. Edwards AIR PUMPS, Worthington CENTRIFUGAL CIRCULATING PUMPS or CONDENSER; would be separated if required; bargain price.—HARRY H. GARDAM and CO., Ltd., Staines 5305 G

DIESEL ENGINES, Six-cylinder, Two and Four-strokes, 250, 1000, 1200 H.P. Excellent condition. DYNAMOS for above, 250 or 500 volts D.C. Immediate delivery and low price.
Also TWO 500 K.W. PARSONS TURBINE SETS, 250 or 500 volts D.C., with condenser and spare armature.
ELECTRICALLY DRIVEN AIR COMPRESSORS, 250 volts D.C., pressures 1500 to 3000 lb. per sq. inch.—JENNINGS, West Walls, Newcastle-on-Tyne. Ex.

FOR IMMEDIATE DISPOSAL.—
ONE New Crossley GAS ENGINE, S.E. 12, 65 B.H.P., complete with Air Compressor and Receiver, Set of Pipes and Bolts.
ONE 45 H.P. MOTOR, by Fuller, single-phase, 400 volts, 140 amps., 50 periods, 850 r.p.m., with Starter (second-hand).
WILLIAM SAINT, Ltd., Cambridge. 5393 G

For continuation of For Sale Advertisements, see page iii.

JULY.

The Conferences.

On the first day of the month the engineering conferences in Westminster, which had opened a few days before, were brought to a conclusion. It has been held in some quarters that a mistake was made in the decision of the Institution of Mechanical Engineers to allow its meetings to overlap those of the Institution of Civil Engineers, but whilst it must be admitted that in some ways there were disadvantages in simultaneous meetings, they were more than compensated by the advantages; for, in the first place, the Mechanicals were able to extend a cordial welcome to the deputation of American engineers who were in London for that week only, and, in the second place, the attraction to the country members of both institutions was increased. The older body, following the precedent of former conferences, handled a variety of subjects and listened to no less than fifty-three papers, whilst the younger concentrated its attention entirely on the burning question of the day, the means of using fuel economically. Sixteen papers were presented, and in nearly all cases were followed by useful discussions. The Mechanicals took the further important step of organising an exhibition of appliances connected with the subject in hand. The wisdom of the Council in adopting this novel course was shown by the large attendance at the exhibition, which up to the hour of closing late on Saturday afternoon was well filled. There was an expression of opinion on all sides that both conferences had proved of great service to the members.

The July Train Alterations.

The coal dispute not only reduced the train services below the winter level, but prevented the introduction of the additional trains which is usually made in May and June. The end of the stoppage restored the services to what they were at the end of March, and on July 11th or thereabouts the summer service was put into operation. Its revival has afforded considerable pleasure to those who take an interest in the speed of trains; it has, moreover, shown that competition in this respect is not wholly dead. The speeds now reached nearly approach those which prevailed before the war. Whilst it is true that we cannot journey between London and Liverpool and London and Manchester in 3½ hours, the 4 hours now taken is excellent running, and quite satisfies the average traveller. From London to Leeds by the Great Northern used to take 3 h. 40 min., and from Leeds to London 3 h. 25 min. Four hours are now allowed, and quite rightly too. The London and North-Western expresses between London and Birmingham were rather trying to some people's nerves when covering the 113 miles in 2 hours in order to hold their own with the Great Western's same time for 110 miles over an easier and less densely crowded road. Now both companies take 2¼ hours. Once again, passengers from London to Edinburgh and Dundee may journey by the West Coast route, and the morning train from Euston reverts to its departure time of 10 a.m., which, until 1917, had been the hour for very many years. Similarly, the East Coast route is available for passengers from London to Glasgow. The morning train from King's Cross is divided; the Newcastle and Edinburgh portion leaves at 9.50 a.m. and the Glasgow, Perth and Aberdeen at 10 a.m. The "Cornish Riviera Express" of the Great Western also runs on Sunday.

The French Tariff.

It was only after a considerable delay that the new French minimum tariff was published during the past month. It awaited a long time the signatures of the Minister for Foreign Affairs and the Minister of the Liberated Regions, the one hesitating to accept a document which would create considerable friction with foreign countries and the other fearing that the higher duties would have the effect of increasing the cost of material required for reconstruction work. There is no doubt that the hesitation of the Minister for Foreign Affairs has been fully justified. The putting up of import duties from three to as much as eight times the pre-war values has rendered the importation of many classes of manufactured goods practically prohibitive. It has created friction with Spain, Switzerland and Belgium, which have been obliged in self-defence to embark upon a tariff war, and if British firms are not to suffer from this protectionist policy, something must be done at once to secure relief. The President of the Republic has openly stated that the new tariffs are a part of the country's foreign policy, by which is meant no doubt that they will be employed as a means of obtaining concessions from foreign countries. But while those concessions are intended to benefit France, the new tariff will still serve as a barrier against the importation of manufactured goods that compete directly with similar French products. Unless the duties can be reduced in favour of particular countries, which appears out of the question, it is not easy to see in what way they can help in the carrying out of the "commercial arrangements."

New Dock for London.

With the formal opening by the King on July 8th of the Albert Dock Extension there was put into service a very important addition to the dock system controlled by the Port of London Authority. The new dock, which is approached from the river by an entrance lock 800ft. long by 100ft. in width and with a depth of 45ft. at Trinity High Water, is 64 acres in extent, and over the greater part of that area a depth of 38ft. has been provided. The dock is 4500ft. long and varies in width from 500ft. to 700ft. A feature of the design is the series of reinforced concrete jetties, seven in number and each 520ft. in length, which has been constructed parallel with the South Quay. Cargoes can be dealt with either from or to barge or quay at these jetties, alongside each of which deep-water berthage has been provided. On the north side of the dock a fine range of warehouses—one of which is completed—is under construction. Independent access to the new water area can be obtained from the existing Albert Dock by a 100ft. passage. A graving dock 750ft. long, 100ft. in width, and having 35ft. over the keel blocks has been built at the western end of the dock. With the completion of these works, following that of the Tilbury cargo jetty recently opened, the first section of the improvement scheme put in hand by the Port of London Authority may be regarded as finished. Other schemes dock extensions are now receiving consideration.

Cheap Production.

There are occasional waves of propaganda in France that accumulate energy for the time being and then settle down to a calm before they are able to produce any practical effects. For a long time, the industrial and commercial communities were carried away by a wave of agitation in favour of an expansion of foreign trade, without which it was declared the manufacturing industries, with their largely developed productive capacity, could not hope to exist. Conveniences must be offered for export by entering into commercial arrangements with foreign countries and by reducing the railway charges and canal freights to the ports and frontiers. At the same time, home industries must be protected and the higher import duties, by shutting out foreign goods, tend to increase values, with the result that the cost of production advances, and those who seek to do trade with foreign markets find that they are unable to produce goods at a sufficiently low price. Therefore, other means have to be found of bringing down the cost of production. The accumulation of raw material has had to be disposed of at prices favourable to manufacturers, but wages are still high, despite the suppression of the indemnities for the increased cost of living that represent a reduction of 20 per cent. on the wages paid a year ago. The suppression of the indemnities was accepted without demur, but when employers attempted to cut wages the unions resisted, with the result that there was a number of strikes during the month, but in view of the irregular employment it is probable that the men will eventually accept the inevitable. If production is to be cheapened, wages must come down. The new Engineers' Federation intends to investigate the question of cheap production in all its different phases, notably in a more regular and economical distribution of raw material, and in employing methods of manufacture that will enhance labour efficiency. There are many perfectly organised and well-equipped works in France, in which the productive costs have been brought down as low as possible, and one of the objects of the Federation is to ensure a general adoption of economical methods whereby the French engineering industries will be able to develop largely the country's foreign trade.

The Royal Agricultural Show.

Although the Royal Agricultural Society's Show, held at Derby during the first week in July, did not succeed in attracting the public to the same extent as did that at Darlington, all things considered the attendance was very satisfactory. When it is taken into consideration that the railway services throughout the whole of the country had been reduced to a small fraction of the normal, it says much for the development in mechanical road transport which has taken place in recent years that such a wonderful exhibition could be organised under the circumstances. The implement section of the Show was the largest and perhaps the most interesting which the Society has been able to get together for many years, and if the number of strictly new appliances did not come up to those at some of the earlier exhibitions, there were on view many really ingenious devices which mark the commencement of revolutionary changes in the application of engineering to farm and estate purposes. As in all other branches of industry, the cost of labour, coupled with the shortened hours, now add materially to the cost of agriculture, and it behoves farmers to make the utmost use of labour-saving devices if the farming industry of this country is to hold its own in the future against foreign competition. There was on show an attachment to the harvester which is the first step in the direction of eliminating all hand labour in the harvest field, with the exception of the driver of the machine. This appliance is intended for standing the sheaves up after the harvester has cut and bound them, and the judges at the Show thought well enough of it to award the makers a silver medal. Unfortunately, the existing world-wide economic conditions did not permit of a large volume of business being done in the implement section, but this can only be a temporary matter, as the food production of the world is as essential as the air we breathe, and before long we shall witness an improvement in the general conditions, which will stimulate all users of machinery for this class of work to seek for improvements which will increase production.

The Railways Bill.

On the first day of the month Standing Committee B finished its consideration of Part I. of the Railways Bill. This part had been under review since June 8th, and the only serious change was in the placing of the Caledonian, Glasgow and South-Western and the Highland in the North-Western and Midland Group, and of the North British and Great North of Scotland with the North-Eastern and Eastern. On July 6th it was agreed by the House of Commons that the Bill should be divided, and Part III. —Railway Rates—was sent to Standing Committee A. The first Committee completed its work on the 19th, and the other finished its on the 21st. Very few changes of moment were made, owing in the main to the able handling of the railway interests by Major Hills, a director of the Midland Railway, and to the uncommonly cheerful demeanour of the Minister of Transport. In the House a time-table was fixed for the remaining stages of the Bill, and five days were allotted for the report and third reading, in order that the Bill might reach the House of Lords by August 10th. The first day devoted to the report stage was the 27th, when the Speaker ruled out of order a proposed clause that railway companies might engage in road transport. Mr. Whitley said that the Bill was for the regulation of railways, and not to give them fresh powers. For the same reason the Speaker ruled out a proposal of Mr. Neville Chamberlain as to canals. In Committee the date for the submission of compulsory schemes had been deferred for a year—to June 30th, 1923—but on report the time was reduced by six months, and the date was fixed for December 31st, 1922. In view of the uncertainties after Government control ceases on August 15th, most of the companies have been on the frugal side in the declaration of their interim dividends. The Minister of Transport has appealed against the decision of the Railway and Canal Commission as to the North British claim referred to in our issue of July 1st. The deduction of £470,000 for December has now been followed by further reductions, aggregating £550,000, for subsequent months.

Reconstruction.

Considering the vast amount of work that has to be carried out in France and in the Colonies, there would appear to be a brilliant future for the French engineering industries; but, unfortunately, while plenty of contracts are ready to be given out, manufacturers cannot accept them unless they are assured of being paid. For the work of reconstruction in the devastated regions there continues to be a lack of funds, and the French Government has been obliged to accept the assistance of Germany, which will supply considerable quantities of material in part-payment of the reparation indemnity. French manufacturers protest, but they can do nothing more, for unless the Germans pay with material the work will never be done at all. For the reconstruction of the collieries and sugar factories, public subscriptions have been applied for, and although it is feared that

the amount of money forthcoming is not large, it may at least permit of contracts being given out to French firms. The hydro-electric power schemes offer the most promising element of activity, for makers of alternators and turbines are already busy; the carrying out of harbour works will necessitate the distribution of important contracts; and the programme of colonial constructions will provide a great deal of employment. Unfortunately, much of this is held up for lack of funds. The financial crisis alone stands in the way of a great industrial revival, and when that is overcome the French engineering industries will not find it necessary to prepare for an intensive export trade, which certainly will not be facilitated by the new fiscal policy.

The London Electric Supply Problem.

THE inquiry into the electricity supply of London, which was opened by the Electricity Supply Commissioners at the Institution of Electrical Engineers on June 14th, has now been completed, and is discussed, as a whole, in another column. The problem which has confronted the Commissioners has been no light one, for the area of supply as provisionally determined contains approximately 1700 square miles, with eighty-four separate electrical undertakings, exclusive of electric railway and tramway systems, operating about seventy-seven power stations. The average fuel consumption, expressed as heat units per kilowatt-hour generated, during the last year recorded was 38,900 B.Th.U., which corresponds to a consumption per unit of 3.7 lb. of coal, having a thermal value of 10,500 B.Th.U., and the first object of prime importance in the scheme is to effect the largest possible reduction in that figure. The many interests concerned in the supply of electricity in London and the local jealousies between the various county and other authorities in the area have proved to be an obstacle to the presentation of one comprehensive scheme, and the Commissioners have found themselves with no fewer than six schemes to consider. One of the principal matters that have been brought to light in the course of the evidence is that at the present time it is more profitable to link up and extend existing stations than to erect new capital stations. The railway companies are not, it seems, at all anxious to take their supplies from the new system. They claim that they can generate current more cheaply in independent stations, but, in due course, they will have to make application to the Commissioners to erect sub-stations. The principal opponent to the policy of not erecting new capital stations at once was Mr. C. H. Merz, who argued that prices were falling, and that plant would, in the future, be purchaseable more cheaply than it is at present.

Inland Waterways.

IN the middle of the month the Committee on Inland Waterways appointed by the Ministry of Transport issued a second interim report. The first interim report, which was issued last February, dealt with the proposed improvement of the river Trent between Newark and Nottingham. It was intimated that the Committee would have further proposals to make in that connection. It is not, however, quite ready to put them forward at the moment, but the introduction of the Railways Bill has, in its opinion, made it desirable that it should lay before the Ministry the broad outlines of the general policy regarding canals, which it thinks should be followed in the future. It is recommended that all the waterway connections in each of the seven groups should be ultimately fused into a single ownership, just as in the Railways Bill six groups of amalgamated railways are proposed. The seven groups are as follows:—(1) The river Trent and its connections; (2) the Yorkshire canals; (3) the Lancashire canals; (4) the canals joining Liverpool and the Midlands; (5) the river Severn with its connections; (6) the river Thames and its connections with the Midlands and Bristol; and (7) the Birmingham Canal and its connection in the Midlands. It is not considered, however, that a mere amalgamation of the existing owners would provide the means for the experiment the Committee has in mind, and it is driven to the alternative of placing each group under a public trust, suitably constituted and with its financial resources supplemented by the aid partly of the State and partly of local authorities having a special interest in the development of the group. It is suggested that Group No. 1—the river Trent and its connections—stands out as pre-eminently suitable for the first experiment. The report was not signed by one of the members—Mr. Ernest Bevin—and was only signed with certain reservations by Sir William M. Acworth.

Modern Marine Oil Engines.

No. V.*

1400 I.H.P. WERKSPOOR TYPE.

EXPERIENCE counts for much in Diesel engine construction, and the fact that the Werkspoor Company, of Amsterdam, installed a motor of that type in the first ocean-going oil-engined vessel would in any case give interest to the design of the engines which the firm is now standardising. The very original features embodied in the Werkspoor design have from time to time aroused a good deal of criticism, which is perhaps best answered by the statement that the engine installed in the pioneer vessel mentioned above bears many features of resemblance to the motors which we are now about to describe. The Werkspoor Company has two licensees in this country—Hawthorn, Leslie and Co. and the North-Eastern Shipbuilding and Engineering Company—and both of those firms are building machinery for installation in motor ships.

The standard Werkspoor engine is of the four-cycle type and is designed to develop 1400 indicated or 1050 brake horse-power—the mechanical efficiency being 75 per cent.—when running at 125 revolutions per minute, and although, as will be mentioned later, some larger motors have recently been built, work has mainly been concentrated upon the production of the lower-powered models, of which at least twenty sets have been built or are under construction. A relatively large stroke-bore ratio has been adopted which allows of a comparatively small cylinder diameter, namely, 560 mm., whilst the piston stroke is 1000 mm. This gives the comparatively high piston speed of over 800ft. per minute; but it is to be noted that the tendency in many other designs is to permit of a somewhat higher figure than was, in the early days, thought to be desirable.

It needs only a glance at the Werkspoor Diesel engine to note that it differs radically in cylinder and framework construction from the designs which have previously been described. In every other type the principle of separate cylinders has been considered essential, although in some cases, and notably in the Harland and Wolff engine, the cylinders are bolted together to form a rigid construction. The engine is, as usual, arranged in two groups of cylinders, and each set of three cylinders is cast in one piece, forming a common water jacket, into which the three separate liners are fixed. This cylinder "beam," as the makers term it, is supported by eight vertical tie rods extending from the bottom of the bed-plate and placed as close to the bearings as possible. The tie rods, which reach to the top of the cylinder beam, the cylinder covers being bolted down separately on to the beam, take all the stresses of tension and compression, while the cast iron columns, which come between the bearings, carry the crosshead guides. In order to stiffen the structure and to prevent vibration which might otherwise arise, cross bracing is provided in the form of diagonal columns, of which there are two at each end of each group of three cylinders. Obviously, this construction, with its simplified casting, is very satisfactory from the manufacturing standpoint, and should be cheaper than individual cylinder design. The objection is sometimes made that it is not sufficiently rigid, but from our experience of the operation of these engines at sea there appears to be no cause for complaint in this direction in motors of this size.

* No. IV. appeared July 29th.

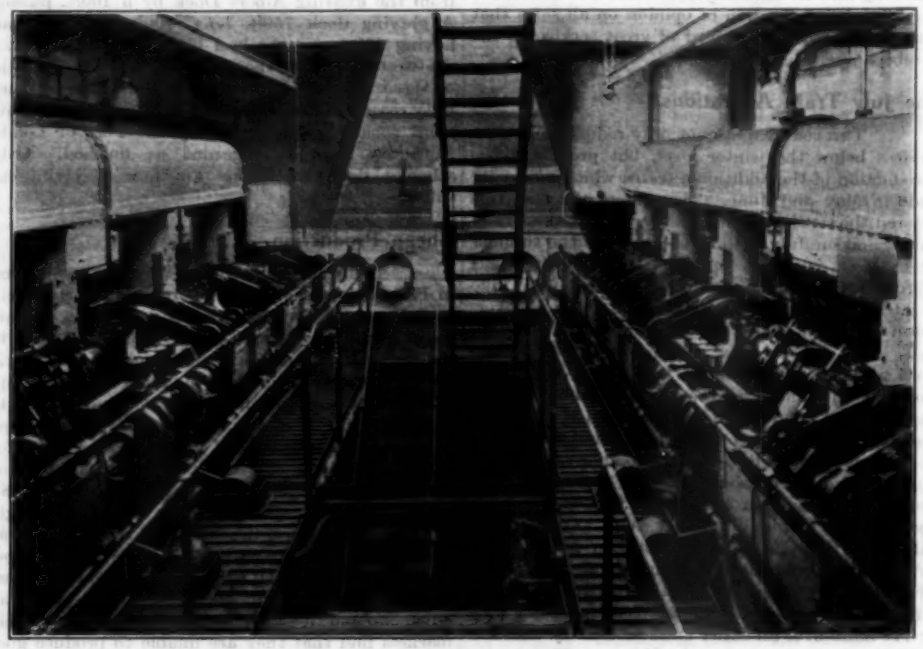


FIG. 18—TOP VIEW OF TWO WERKSPOOR ENGINES, SHOWING VALVE GEAR

In connection with the valve mechanism the designers have in their new engine adopted some of the features of their earlier types, but a new system of reversing has been employed. Practically alone among Diesel engine manufacturers, the Werkspoor Company drives its cam shaft through connecting-rods in the centre of the engine, which can be seen in Fig. 19, which shows a 1400 indicated horse-power engine. There are four of these rods, which take the form of pipes, and they are driven by a crank shaft operated through spur wheels from the main crank shaft. On the cam shaft are the usual two sets of ahead and astern side-by-side cams for the operation of the fuel, exhaust, air inlet, and starting valves in the cylinder cover. A new feature is introduced in the arrangement of these valves, since the fuel valve is not, as usual, centrally placed, the object being to allow increased spaces for the passage of cooling water between the valves. Whether this is necessary or desirable seems to be a matter of some doubt, since other builders do not appear to have experienced difficulties with cylinder covers when the fuel valves are centrally placed, and it would appear that the admission of fuel at a point other than the centre of the cylinder must possess disadvantages. The fuel valves in the engine illustrated in Fig. 20 are remarkable in another respect, for instead of being returned to their seats by means of an ordinary spring, the operation is effected by a horizontal spring with four leaves, fixed to the vertical exhaust pipes discharging the exhaust gas from each cylinder to the main exhaust pipe above.

Possibly in course of time when patents expire there will be some universal system adopted for reversing marine Diesel engines. For whilst the main principle of providing side-by-side cams on cam shafts for ahead and astern running respectively is almost invariably employed, the methods adopted for bringing the cams into operation vary in nearly every engine constructed. It may well be imagined that some advantage would accrue if the best points of each type were incorporated in one design. The manufacturers of the Werkspoor engine have struck a new note, for whilst providing the ahead and astern cams side by side on the cam shaft, for actuating each valve they have eliminated the necessity of moving the cam shaft fore and aft. An examination of Fig. 18, which illustrates the tops of two Werkspoor engines, will show that the exhaust, inlet, and starting air valve levers operating the valves in the cylinder head are carried excentrically on a horizontal shaft on the top of the engine.

When reversing, in order to bring the valve lever rollers over the astern cams on the cam shaft, the shaft, on which the levers are pivoted, is turned by means of an ordinary air reversing motor operated from the control station. The first effect of this is to lift the rollers above the cam shaft. The result of the continued rotation of the pivoting shaft is to bring down the valve lever rollers on to the adjacent astern cams, owing to the fact that the valve levers are mounted slightly askew, the valve levers thus having moved the distance between the two cams out of the straight. At the operating end of the valve levers are two tappets for actuating the valves to correspond with the two positions of the rollers at the other end of the levers. There is only one cam for the fuel valve, and the lever operating it is not mounted askew on the pivoting shaft, as is the case with the other valves. The rotation of this shaft, however, allows for the timing of the opening of the fuel valve to correspond with astern running, since the fuel valve

lever is excentrically carried on the pivoting shaft. Although on first examination this reversing system, on account of the fact that whilst the engine is running astern the valve levers are operating out of line, does not appear very attractive, there is no question that a good deal of gear is thereby dispensed with, and as the period of astern running is in any case comparatively short, it is possible that the advantages outweigh the disadvantages. At all events, no troubles appear to have been experienced in any of the ships equipped with engines employing this system.

The use of compressed air for operating the reversing mechanism of a Diesel engine has now become so common that it is interesting to note that the Werkspoor Company employs alternatively compressed air and hand-operated gear. It will be remembered that in the Doxford engine the reversing system is operated by hand, but in most other designs dependence is placed upon compressed air. It is known that trouble has occasionally arisen with the compressed air system—although there is no reason why that should be the case—and consequently some shipowners show preference for a gear in which all operations are carried out by hand power. In the Werkspoor engine illustrated in Fig. 20 the compressed air system is utilised and the levers to be seen at the starting platform are used for the control. The second lever on the left brings the air servo motor into operation when reversing and sets the valve gear for running in the astern or ahead direction as required. After this operation has been effected the first and third levers from the left—each of which controls one group of three cylinders—are moved to the "air" position. This brings the rollers of the starting valve levers on to their cams on the cam shaft, since these levers are mounted excentrically on the pivoting shaft and the excentrics are coupled to horizontal shafts seen just below the cam shaft in Fig. 18. The two control levers, when moved, operate this shaft and so bring the air starting valve levers into action; at the same time, owing to a similar connection between the horizontal shaft and the fuel valve levers, the fuel valves are held out of action. The engine, therefore, starts up on air and the two control levers are next moved on to the fuel position. This brings the fuel valve levers into action and takes the starting air valve levers out of contact with their cams. The engine then runs normally on fuel and can be speeded up in the usual manner by shortening the period during which the suction valves of the fuel pumps are open.

In the early days of the construction of the marine Diesel engine it was common to follow land practice, and to employ one fuel valve for a complete engine distributing the fuel to each separate cylinder. Most manufacturers have abandoned this principle, but the Werkspoor Company still retains a modification of the idea. There are two comparatively large fuel pumps driven off the engine; they supply oil to what is called the floating chamber, which is well above the level of the top of the engine. In this chamber the fuel is under a pressure of compressed air and is maintained at a predetermined level by a system of balance weights. The oil is delivered under that pressure to two distribution boxes, each of which supplies three cylinders. The branch pipes from the distribution box to the individual cylinders are provided with shut-off cocks. The disadvantage of this system is that different amounts of fuel may be delivered to each cylinder, so that one cylinder may become overloaded, whilst the advantage is that a breakdown on one or more fuel pump has no immediate effect upon the engine, as would be the case in a design with one fuel pump for each cylinder. The two fuel pumps in the Werkspoor engine are of the horizontal type and are driven directly off the crank shaft. One of them is virtually a stand-by.

Even in the arrangement and design of injection air compressors the manufacturers of the Werkspoor engine have departed from accepted practice. The compressor is arranged at the back of the engine and is driven off one of the crossheads. The auxiliary pumps for the circulating water and the lubricating oil are also driven off the main engine, with the object of providing a completely self-contained unit. One or two other unusual features are to be noted in the construction, notably the quick method of adjusting the main bearings. There is a wide wedge under each bearing, through which pass horizontal bolts extending to the front of the engine through the framing; by screwing up these bolts the wear of the bearings can be taken up in a very simple manner.

Sea water is employed for cooling both pistons and cylinders, and a somewhat specialised form of telescopic pipe is provided for the admission of the cooling water to the pistons, with a separate pipe for the discharge of the cooling water. As is now becoming usual, a tray is provided under the cylinder to collect any lubricating oil or water that may leak out, so as to prevent its mixing with the oil in the sump. The lubricating oil is pumped from the crank case up to a tank well above the top of the engine after passing through a filter. Gravity feed is utilised for every point requiring lubrication in the engine, except the cylinders.

Briefly, it may be stated that the Werkspoor engine is mainly of interest to engineers owing to the temerity which the manufacturers have shown in following along ideas of their own, without reference to what has generally been considered standard practice in Diesel engine construction. In this policy it is only fair to say that they appear to have achieved successful results.

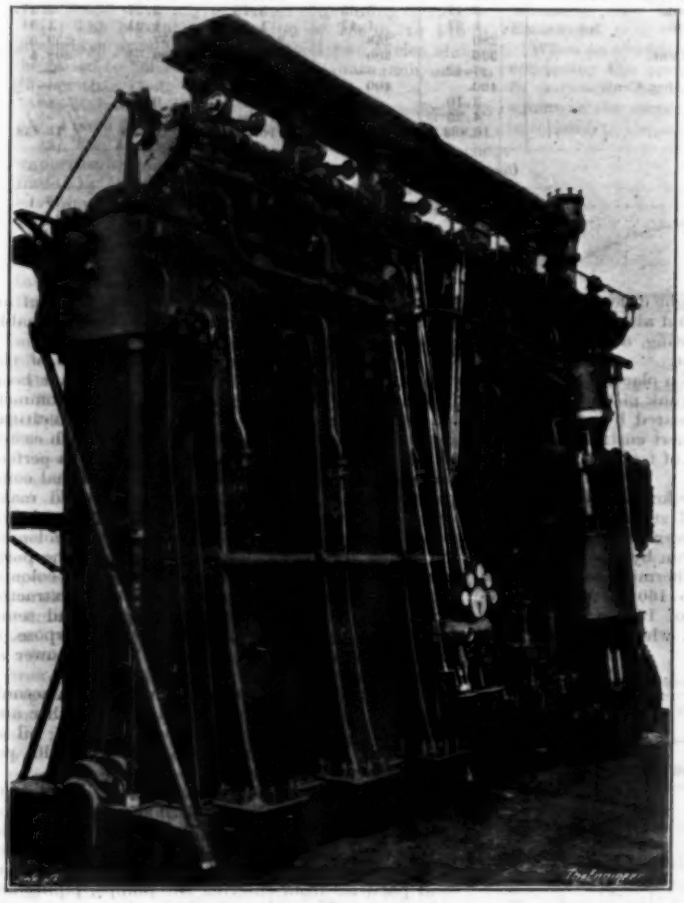


FIG. 19—1400-I.H.P. WERKSPOOR MARINE DIESEL ENGINE

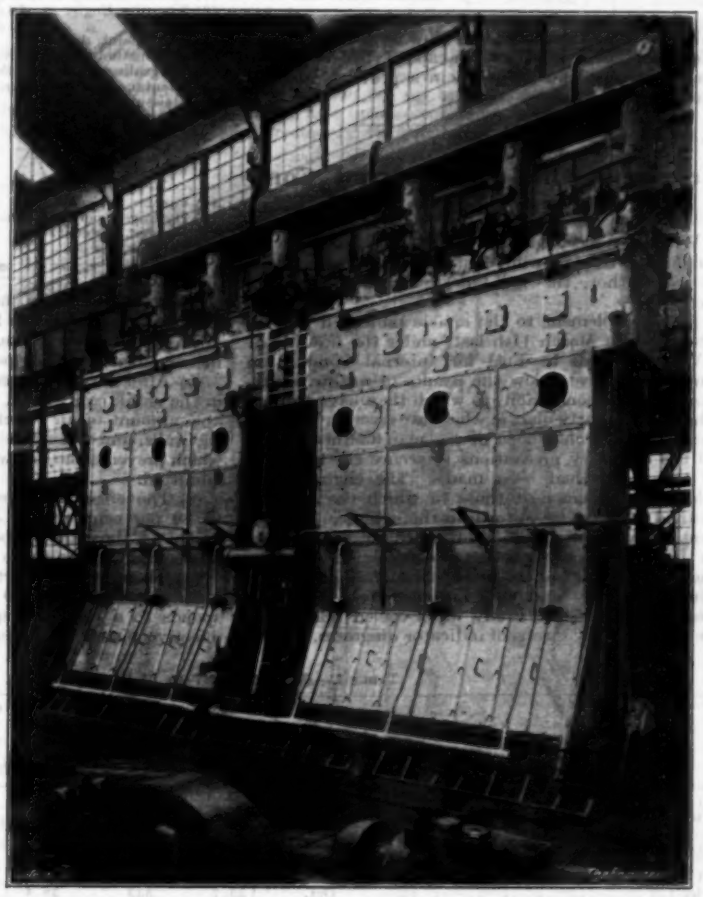


FIG. 20—1400-I.H.P. WERKSPOOR ENGINE WITH MODIFIED CONTROL GEAR

Spectroscopic Examination of Converter Flame.

By W. J. CAMPBELL.

THE spectroscope is more extensively used on the Continent than in this country for the examination of converter flames. The usual practice here is to take the blow completely down, thus eliminating practically all the carbon, and thereafter to re-carbonise with suitable fluid metal additions. In many Belgian and Swedish foundries engaged in the production of small steel castings the blow is brought down before the flame has completely dropped. Without any additions of re-carbonisers the molten metal may contain 0.40 per cent. to 0.60 per cent. carbon. The usual additions are added molten. The resultant steel is extremely hot and fluid, and is shanked from the converter in hot crucibles. The amount of short-run castings and skulls is considerably lower than with the usual procedure of completing the blow and either casting low carbon steel or adding high carbon metals.

The spectroscope is useful for indicating the point at which to bring down the blow in the second method of working. Many attempts have been made to obtain higher carbon steel by this method without the use of a spectroscope, but the great uncertainty and the erratic results secured condemned the practice. With the aid of the spectroscope better and more regular results may be obtained, but the process is still not so accurate as the practice of completely blowing and re-carbonising for obtaining a pre-arranged carbon content to within, say, a few points. The spectroscope is not so essential for judging the finish of the blow as for examining the carbon flame before the whole of the carbon has been completely burnt off.

At the beginning of the blow the spectrum is continuous and indefinite. With the faint appearance of the flame the characteristic yellow line of sodium is seen. For a short period this line is very faint and appears in flashes. As the flame gradually increases and becomes steady the sodium line becomes stationary and brighter. As the flame and temperature rise the spectrum lines become more complex. The line spectrum of thallium and lithium and the banded spectrum of many other metals may be observed, but they are not of any particular value for the control of the blow. The principal lines to be noted are the carbon lines, which appear bright green. They are faint at first, but gradually as the flame rises, they become brighter and more distinct, until, with the falling of the carbon flame, they diminish in number and fade completely away with the final drop of the flame.

The advantage for many classes of small foundry

work of obtaining very hot and fluid steel may well repay the cost of installing a spectroscope. As already stated, the method is not infallibly accurate, but with experienced judgment of the carbon lines and the timing of their appearance, together with the maximum height of the flame, it is extremely helpful for controlling the process and obtaining steel containing high carbon steel without re-carbonising.

The following table gives a brief outline of an average blow and its spectroscopic examination.

Spectroscopic Examination of Flame.

Duration of blow.	Eye observation.	Spectroscope observation.
3 min.	Sparks, but no flame.	Faint flashes of sodium line in continuous spectrum.
3 to 10 min.	Flame gradually appearing at mouth of vessel and increasing.	Yellow sodium line becoming stationary and bright. Also lines of thallium and lithium and bright green carbon lines.
10 to 12 min.	Flame brighter and longer and temperature rising.	All the above lines fixed and brighter, the carbon lines being especially clear.
12 to 14 min.	Flame at maximum height and brightness.	Addition of green carbon lines in blue and green. All lines at their maximum brightness.
14 min. to completion of blow.	Flame falling gradually.	Carbon lines not so luminous and gradually fading with dropping flame and eventually disappearing with the end of the blow.

The above is the record of a blow from a "Walrand Légenesel" converter of 1-ton capacity. The process was illustrated and described in a previous issue of this journal.

Vegetable Oils for Internal Combustion Engines.

We have received, and have much pleasure in publishing, the following contribution from Monsieur R. E. Mathot, the well-known Belgian consulting engineer :—

As a complement to the article published in The Engineer of March 11th last, under the heading of "Vegetable Oils as Fuel for Internal Combustion Engines," I give below the results of my investigations and the conclusions to which they have led me. The engines, particulars of which are given in Table I., were tested in the shops of the manufacturers after all the necessary precautions to secure the accuracy of the results had been made. The engines were selected from amongst those in which the obsolete method of injecting water into the cylinders for preventing overheating had been dispensed with, thanks to the use of a proper design of combustion chamber, such as is applied to the two-cycle engines of Petters, Limited, Robey and Co., Limited, &c. The tests were made with the Prony water-cooled brake, and were checked by means of indicator diagrams.

Table I.—*Particulars of Tests of Engines.*

Make and type (bore by stroke, inches).	Date of tests.	B.H.P.	R.P.M.	M.E.P. lb. per sq. in.	Oil consumption per B.H.P. hour in pounds.		
					Palm.	Cotton.	Mineral (heavy).
(1) *Gardner*, Patricroft. Two-cycle vertical, 8½ by 9½	1920 June	16.25	356	41	.71	.71	.56
(2) *Ideal*. Four-cycle, 9½ by 17	June	22	—	—	—	.57	.52
		25	228/32	82	—	.59	—
		12	—	—	—	.65	.60
(3) *Kromhout*, Amsterdam. Two-cycle, 11 13/16 by 12½	Oct.	33.5	335	37	.64	—	—
		35.7	333	38.4	—	.61	—
		23.5	406	41	—	—	.57
		27.3	411	—	—	—	.64
(4) *Ansaldo*, Turin. Two-cycle, 9½ by 16⅝	1921 Feb.	21.1	423	—	.69	—	—
		24	—	—	.72	—	—
		22.8	412	—	—	.66	—
		25.7	413	—	—	.75	—
(5) *Anglo-Belgian*, Belgium. Two-cycle, 10½ by 11 13/16	March	25	384	33	—	—	.54
		25.5	384	—	.69	—	—

With the exception of No. 2, which was a four-cycle, single-cylinder horizontal engine with high compression, the other engines were of the two-cycle single-cylinder vertical types with crank-case air scavenging.

In each case the palm and cotton-seed oils were heated to about 50 deg. Cent. by contact with the exhaust pipe, so as to make the viscosity satisfactory. The engines were started with mineral oil after having their hot bulbs heated from the outside with a torch lamp. When the normal working temperature was reached, after some minutes, the vegetable oil was substituted for the mineral oil, and the change did not, apparently, affect the working of the engine, either from the point of view of speed or from that of the power developed.

Engine No. 1, when running on palm oil, had an almost invisible exhaust. In it, however, as well as in engines Nos. 3 and 4, the exhausts of which were slightly smoky, a carbon deposit of ⅛in. to ¼in. thickness was formed after three or four hours' working, at the spot where the spray of the pulveriser struck the hot cap. This drawback would evidently increase after a longer time of working, and can only be cured by improving the pulverisation. The analysis of the deposit showed from 90 to 95 per cent. of carbon and from 5 to 10 per cent. of mineral residue, such as lime, silica, &c. In engine No. 4—Ansaldo—the automatic air inlet valve to the crank case was replaced by a mechanically operated revolving valve. In each of the two-cycle engines tested, the supply pump needed readjustment, so as to make the time and duration of the injection suitable for the nature of the fuel.

The engines were tested at their normal working loads implying a margin of from 10 to 15 per cent. for momentary overload. Assuming a mechanical efficiency of 80 per cent., derived from accurate tests, the mean effective pressure—M.E.P.—works out at between 31 lb. and 41 lb. per square inch, which is very low when compared with the M.E.P. of 75 lb. to 85 lb. obtained in modern four-cycle engines. This fact leads to the conclusion that the two-cycle engines under consideration are far from taking the best advantage of the explosive mixture.

The loss of efficiency is due to several reasons that may be summed up as follows :—

(*a*) In two-cycle engines with crank case scavenging provided with automatic air valves, the latter are caused to move under such slight differences of pressure that they open too late and also close too early during the intake stroke, allowing, at most, a volumetric efficiency of 80 per cent.

(*b*) After scavenging has taken place, there remains in the crank case and in the trunk piston a considerable amount of air which is heated by contact with the walls, and constitutes an inert cushion of hot air, which prevents the full weight of fresh air from being admitted.

(*c*) The effective piston stroke is reduced to 75 to 80 per cent. of the actual stroke owing to the height of the exhaust ports corresponding to 25 to 20 per cent. of the space overrun by the piston.

(*d*) There is an important thermic loss due to the low compression of 140 lb. to 160 lb., which corresponds to a clearance space of 18 per cent. of the effective piston displacement, when compared with engines having compressions of from 280 lb. to 400 lb., representing a clearance space of 9 to 8 per cent. Not only does the low compression afford a larger detrimental cooling surface in the vaporiser, but the latter permits much more burnt gases to remain in the cylinder and to spoil the incoming fresh air.

It may be stated that the type of engine under consideration is handicapped regarding perfect combustion by the lack of air, especially when the engine is running at from 10 to 15 per cent. above its normal load. This is illustrated by the smoky exhaust that occurs in this case, as well as by the large increase of fuel consumption. Theoretically, for complete combustion, 1 lb. of oil requires from 11 lb. to 12 lb. of air, and, practically, about twice that weight of air is required in the engine; while if the causes of loss due to defective scavenging are taken into account, it will be found that we are far from supplying the right amount of air in the combustion chamber. In the course of my tests I have also found that the exhaust boxes, while effective as silencers or mufflers, seriously hamper the free scavenging effect, leaving in the cylinder an abnormal amount of products of combustion that dilute the incoming air.

Recapitulating the drawbacks of the regular two-cycle semi-Diesel engine, I venture to say that to meet the requirements of engines intended for the colonies, the following conditions must be fulfilled :—

(1) The hermetically closed crank case acting as air scavenger should be dispensed with :—(*a*) Because it renders the connecting-rod brasses inaccessible for repairs while they are exposed to overheating in the hot atmosphere in which they work; (*b*) it is responsible for the high consumption of lubricating oil which is spread about by the crank, then vaporised and withdrawn by the scavenging air to the cylinder. Certain tests have shown a consumption of lubricant of 23 grammes instead of 3 to 5 grammes per brake horse-power-hour, as in four-cycle engines!

(2) The fuel pumps are operated by cams or by excentrics that do not provide for regulation of the timing according to the variable nature of the vegetable fuels, which may require earlier or later injection according to their flash point or temperature of combustion, or may require a shorter or longer duration of injection according to their viscosity, &c.

(3) Starting by heating with a torch fed with petrol or paraffin is an inconvenience, for it necessitates keeping a stock of such fuels, which are scarce and expensive in colonies. Moreover, the use of an open flame may be dangerous in case of inflammable goods in the neighbourhood of the engine.

Table II.—*Particulars of Vegetable Oils (without Water or Impurities).*

	Palm.	Arachis (ground nut).	Cotton seed.	Sesame.	Average.
(1) Specific gravity at 15 deg. Cent. (H_2O = 1000)	913.8	926.4	923.5	922.2	921
(2) Viscosity Engler at 50 deg. Cent.	3.47	3.63	3.43	3.37	3.47
(3) " " 100 deg. Cent.	1.27	1.47	1.29	1.21	1.31
(4) Flash point, deg. Cent.	280	258	243	257	259 5
(5) Combustion temperature, deg. Cent.	325	300	286	299	302.5
(6) Congealing point, deg. Cent.	27–42	—	—	—	—
(7) Spontaneous combustion in air, deg. Cent.	400	400	—	—	—
(8) Moisture, per cent.	3.10	0.09	0.1	0.08	—
(9) Impurities, per cent.	4.25	traces	traces	traces	—
(10) Calorific value B.Th.U.	16,884	16,924	16,785	16,840	16858
Composition.					
(11) Carbon, per cent.	76.80	76.6	77.25	76.80	77.1
(10) Hydrogen, per cent.	11.90	12.1	11.7	12.13	11.9
(11) Oxygen, per cent.	10.90	11	10.65	10.50	10.6
(12) Sulphur, per cent.	0.009	0.012	0.008	0.01	0.1

The physical and chemical characteristics of the vegetable oils I have experimented with have been determined by the expert chemist, Mr. Belhommet, and are given in table No. II. Similar investigations should be carried out in connection with castor oil, which calls for special attention, as it is a perfect fuel and also a first-class lubricant for internal combustion engines. This latter feature should make castor oil a suitable substitute for the mineral lubricants, the price of which is prohibitive in colonies, and which are hardly obtainable far from the ports or railway stations. According to certain colonial authorities, the plant from which the oil is extracted grows as a weed in almost all tropical and semi-tropical countries. If cultivated for the purpose, it may become a valuable source of motive power in every colony.

Recent tests made on an engine built in accordance with my suggestions by Messrs. Weyher and Richemond, of Paris, have burnt castor oil as successfully as palm oil at the rate of 0.52 lb. per brake horse-power-hour.

Although the analyses given in Table II. relate to the waterless and pure materials, it should be observed that, in actual practice, the oils may be used in the state they are produced by the natives, provided they are submitted to a preliminary filtering to prevent solid particles from entering the pumps, piping and pulverisers. The palm oil, obtained in a semi-solid state, should be melted and kept liquid at about 50 deg. Cent. by means of the heat of the exhaust pipe or of the circulating water. The same treatment should be applied to castor oil so as to bring its viscosity in the neighbourhood of 1.2–1.5 deg. Engler at 100 deg. Cent.

It is worthy of note that the four types of oils analysed show nearly the same characteristics with the exception of the flash and combustion points, so that the figures of all only depart slightly from the averages shown in the last column of the table. The calorific values determined by the Mahler bomb agree very closely with the figures deduced from the chemical analysis after Dulong's law. Yet, the average heat value of 16,858 B.Th.U. does not agree with that set forth by some authors—say, 15,500 B.Th.U. If the correct heat value of 16,785 B.Th.U. is applied to the lowest consumption recorded by our tests—say, 0.61 lb.—the thermal efficiency only works out at 24.5 per cent., while with moderate compression four-cycle modern British engines, the thermal efficiency varies between 28 and 30 per cent. So that while the regular two-cycle engine is satisfactory from the mechanical standpoint, it must be admitted that it is far from perfect from the thermal point of view.

Suggested Improvements.

Taking into account the criticisms raised regarding the regular make of two-cycle engines, I am of opinion that the manufacturers should aspire to follow the following suggestions, with the object of

improving the design of their engines in order more closely to fill the requirements of colonial service.

(1) For instance, the crank case should be either of the open type, or, if of the closed type, it should afford free access to the crank, connecting-rod and main bearings, nor should it act as scavenging air pump. The scavenging could be effected in one of three other ways :—(*a*) with a piston and pump body quite independent, as in the case of two-cycle Diesel engines ; (*b*) with the working piston provided with a rod, the lower part of this piston acting as an air pump in a suitable cylinder provided in the bed frame, the latter acting as an air receiver ; (*c*) with a stepped or differential piston, the larger diameter of which should act as an air piston with an air receiver as above. The first proposal appears to involve mechanical complications that would unfavourably influence the cost of construction ; the second proposal, owing to the use of a piston-rod, crosshead and guides, would lead to an increase of height of 25 to 30 per cent., and would proportionally increase the weight and the price of the engine ; the third proposal, namely, that providing for a differential piston, seems to be most advantageous and the least complicated with regard to weight of parts and cost of manufacturing.

(2) In larger engines, the prices of which allow some constructional refinements, the automatic air valves should be replaced by mechanically operated slide or revolving valves, for the sake of improving the volumetric efficiency of the air-scavenging device.

(3) The regular compression of 150 lb. to 170 lb. nowadays applied in the vertical two-cycles should be raised to 250 lb. to 300 lb. per square inch, or even higher than that.

(4) Exhaust ports should be specially designed to avoid back pressure that hampers free scavenging.

(5) The hot plates and such other parts of the vaporiser or combustion chamber as are liable to be fouled by the fuel injection, should be provided with easy means of dismantling for the purpose of cleaning even when still hot.

(6) For the sake of fulfilling the requirements of the different kinds of fuel oils, either mineral or vegetable, the pumps should be provided with means for timing the injection.

(7) Starting from the cold should be realised by means of the electric spark or of any other ignition process which allows an open flame to be dispensed with.

The tests which the author has carried out have led him to the conclusion that the so-called semi-Diesel engines, whether they be of the two or of the four-stroke cycle type, will work perfectly with vegetable oils. They will be quite reliable and economical prime movers for the colonies when they have been improved to such an extent that their operation and upkeep can be entrusted to the natives, and also when their consumption of vegetable oil fuel, and specially of lubricant, shall have been made comparable with those obtained with good modern engines running on mineral oils. In other respects we may conclude that, in the present conditions, the engines which I have submitted to tests will deliver 10 brake horse-power-hours at a cost of 8d. to 10d. with vegetable oils, such as palm oil supplied on the spot and before having been subjected to costs of handling and freight. The two-cycle vertical engine, with its wide range of power varying from 3 to 400 horse-power, seems to be the one that best answers the requirements of colonial service, whether for stationary or marine purposes. For stationary uses it does not require heavy foundations, and the relatively light weight of the parts, when dismantled, suits the conditions of transportation. It lends itself very well to the operation, either by belt or directly connected, of dynamos owing to its high speed and to the good cyclic regularity which is a characteristic of the two-cycle engine. For marine work it recommends itself by reason of the small space required and for its simplicity and elasticity. Moreover, the arrangement of the crank shaft is perfectly suitable for coupling it to a propeller shaft.

With regard to the tractor engine, whether for hauling goods on roads or for operating agricultural machines on the fields, the question is of a more complex nature. Professor Laplae, the expert General Director of the Belgian Ministry of Colonies, who, with the members of the Union Coloniale, is a pioneer in the matter of mechanical traction on roads, has demonstrated its great importance for the Congo. It will solve the vital question of transportation for the interior, and allow native porterage, which is an obsolete and most expensive method from both the humanitarian and the economic points of view, to be dispensed with.

Vegetable oils not being volatile, there is no possibility of using them with regular carburettors, so that the only means nowadays available is to pulverise the oil in the combustion chamber of so-called semi-Diesel engines when, towards the end of the compression stroke, the pure air has reached a compression pressure of at least 150 lb. per square inch. The oil is then ignited by the effect of the combined heat of compression and of the hot walls of the combustion chamber.

The process implies the use of small fuel pumps which, under the control of the governor, supply the oil to the engine through a pulveriser nozzle with a very small hole, so as to obtain, owing to the high injection pressure, a great velocity, causing the atomisation of the fuel. Such mechanism is already rather small and complicated as it is used in moderate-sized engines running at 200 to 400 revolutions. It will become very tiny and delicate when applied to small high-speed motors running at 800 to 1000 revolutions, to suit the size and power of a tractor.

Yet the problem is not insoluble, and it is already being tackled by some expert mechanics, who may soon be in position to put on the market a reliable vegetable oil motor for colonial tractors.

The Ajax-Wyatt Electric Furnace.

By JOHN B. C. KERSHAW, F.I.C.

The issue of The Engineer for January 14th contained an illustrated article by the present writer upon "Electric Furnaces for Non-ferrous Metals," and in the course of that article a short description was given of the Ajax-Wyatt type of induction furnace. A considerable amount of new information relating to this furnace has come into the writer's hands since the earlier article was written, and as this furnace appears to be the most successful surviving form of the Kjellin and Colby electric induction type, as applied to metallurgical work, some further details concerning its principles of construction and working efficiency may be of interest to readers of The Engineer.

When an electric current is passed through a molten conductor the cross section of the conductor tends to contract. As this contraction increases with the square of the current, if the current be heavy enough in relation to the area of the conductor to produce this effect, the cross section of the conductor will gradually diminish until the circuit is "pinched off" and broken. Dr. Carl Hering, of Philadelphia, was the first electro-metallurgical engineer to note and apply the "pinch effect" principle in the construction of an electric furnace. The Ajax-Wyatt furnace is an application of the "pinch effect" to the induction type of furnace, and it is constructed under licence from its original discoverer. It must be noted that the "pinch effect" does not occur when steel is being melted, since, owing to the comparatively high electrical resistance of steel, the current flowing through the molten metal is not sufficient to produce the necessary contraction in the cross sectional area. With metals of low electrical resistance, such as copper and brass, the "pinch effect" is always observed with heavy currents, when the furnaces are of the open-channel type and the molten ring secondary is in the horizontal plane.

The horizontal open-channel type of induction furnace has, however, been found unsatisfactory when it is desired to make use of the "pinch effect" for heating purposes, since after the electrical contact is broken between the pinched-off ends of the molten metal the flow of current ceases and the force of gravity is not sufficient to bring the two ends of the ring together again. This difficulty has been overcome by placing the secondary ring of the furnace in the vertical instead of in the horizontal plane, and by providing a reservoir of molten metal above the two open ends of the vertical channel. The weight of the metal above the ring is then sufficient to counteract the "pinch effect," and in its place a "pump effect" is produced, which occurs without any actual break in the conducting medium or in the flow of current, and a very rapid heating and circulation of the molten metal is therefore obtained.

Fig. 1 is a diagrammatic cross section of one of the "resistors" of the original Hering furnace, and shows that the "pinch effect" in this furnace was obtained by use of short columns of molten metal contained in small circular pockets or tubes in the floor of the furnace. The current was conveyed to these "resistors," as they were called, by the water-cooled electrodes which closed their lower ends. Heat was developed in the metal contained within these tubes or pockets, and an energetic circulation was set up, as shown by the arrows in the sketch. This type of furnace was not found satisfactory in practice, owing partly to the difficulty of protecting the electrodes and the refractory material in which they were embedded from the rapid action of the molten metal. Moreover, the heat efficiency was also very low, owing to the necessity of using water cooling in order to prevent the electrodes from melting. This difficulty, of course, does not exist in the induction type of furnace, which dispenses with electrodes ; and therefore the combination of the Hering "pinch effect" principle with the induction method of electric heating solved the problem of electrode maintenance and led up to the development of the Ajax-Wyatt type of furnace.

In its simplest form the furnace is shown in sectional elevation and plan in Fig. 2, the arrows indicating the circulation path of the molten metal. Magnetic leakage from the transformer core is minimised by flattening out the cross section of the channel which carries the molten metal and forms the secondary loop of the transformer. This secondary loop, instead of being circular or semi-circular in shape, is designed in the form of a V, with the hearth of the furnace making the connection across the top. The acute angle at the vertex of the V is said to increase the circulation set up by the pumping or motor effect. The first furnace constructed upon this principle was erected in 1915 and was started on ingot and slab metal in January, 1916. Fig. 3 illustrates more fully the details of the method of construction of these furnaces. The laminated iron transformers used are of the three-legged type, and the central leg is placed within the resistor or secondary loop which contains the molten metal. The primary coil and the transformer are enclosed in a casting and are cooled by the air blast from a small rotary blower.

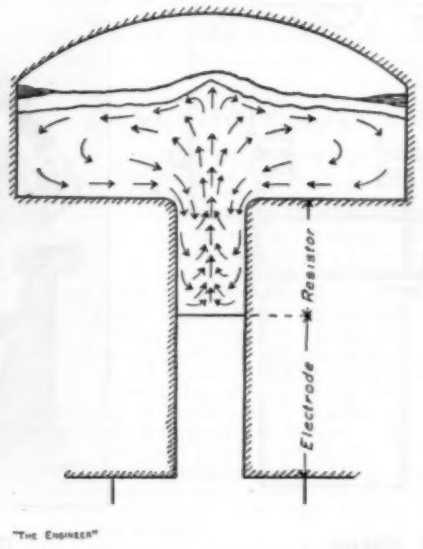


FIG. 1—DIAGRAM OF ORIGINAL "RESISTOR"

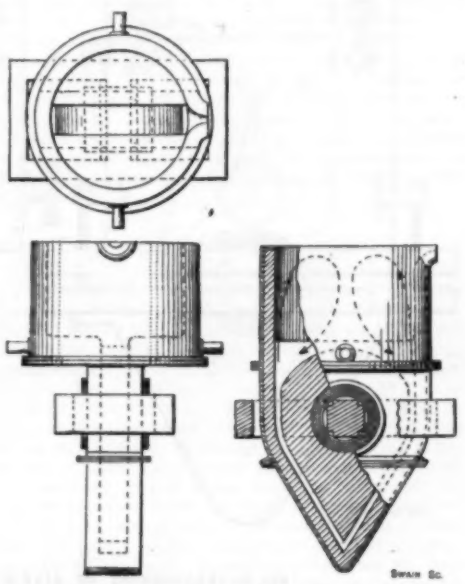


FIG. 2—SIMPLE FORM OF AJAX-WYATT FURNACE

According to G. H. Clamer, who read a paper upon "The Induction Electrical Furnace" before a joint meeting of the Franklin Institute and the Philadelphia Section of the American Institute of Electrical Engineers in March, 1920, in the Ajax-Wyatt furnace some pinch force is exerted under existing conditions, and the Joule heating effect also acts in an advantageous manner. The predominating force, however, is that resulting from the motor effect, for motor effects of considerable magnitude are set up at the acute angle which is in the current path of the secondary loop at a point farthest from the pool. Dr. Edwin F. Northrup, in fact, has calculated the forces due to motor effect as they exist in the Ajax-Wyatt furnace, and has shown that these forces are of striking relative magnitude.

Fig. 4 shows the latest form of the furnace as employed for brass melting. The Bridgeport Brass Company has modified the construction of this furnace by providing a special door at the back for skimming and charging, just above the level of the metal. H. W. Gillett, in an article published in *The Foundry* in June, 1920, gives the following information concerning the construction and working of the Ajax-Wyatt furnaces. The furnace was first made in a 30-kilowatt size, pouring about 300 lb. per heat. The standard size is now 60-kilowatt, pouring about 600 lb. per heat. These furnaces take 220 volts single-phase power and, on a 60-cycle line, they have a power factor of 81 for the 60-kilowatt and 87 for the 30-kilowatt size, which is a highly satisfactory figure

for an induction furnace. The furnace is lined with asbestos cement, which must be uniformly mixed and tightly rammed. The resistor loop is formed by ramming the lining about a brass casting which is left in, and after slow and careful air and oven drying, to drive out moisture and set the cement, the hearth is heated by the flame from a gas torch. Molten zinc is then poured in and low-voltage power is applied. When the brass casting is sufficiently heated to alloy itself with the zinc and to melt, the full power is applied, and more brass scrap and copper are added to bring up the metallic contents of the bath to the proper composition. When it is requisite that the furnace should shut down, all the metal must be drained from the resistor, since, if it be allowed to solidify in it, the lining will be cracked and ruined. When starting after a shut down the furnace is warmed by a gas flame; molten zinc is then poured into the resistor and scrap brass is finally fed in as for the original start.

If suitable precautions are taken in lining, drying and operating the furnace, a good life for the lining is obtained. The 300 lb. size runs from 75 tons to an average of 250 tons, and sometimes gives as high as 375 tons at the Bridgeport Brass Company. The 600 lb. size at the American Brass Company's works averages 400 to 600 tons on 60/40 or 70/30 brass, with some linings lasting for over 750 tons. The lining stands less well against alloys high in lead, but the American Hardware Company, melting an alloy with 30 per cent. zinc and 5 per cent. lead, averaged about 60 tons per lining in the 300 lb. size. The makers in the past have not recommended the furnace for alloys of over 3 to 3½ per cent. lead, but they now state that it will deal with alloys containing up to 6 per cent. lead.

The disadvantages of the Ajax-Wyatt furnace are its limited field of application and the difficulty of finding a refractory material for the lining which will stand the action of molten alloys high in lead; but for the special work of melting yellow brass, on a scale which permits the continuous operation of the furnace, the furnace is the most efficient of the types of electric furnace that have been employed for this work, and, as shown by the figures given in Table II. of the earlier article, the 60-kilowatt size can melt 6 to 7 tons of yellow brass per twenty-four hour day with a power consumption of only 218 kilowatt-hours per ton.

It is generally assumed that the sand drag was a German invention. Where used for arresting the progress of trains which have got out of control when descending inclines this is probably so, but for quickly pulling up wagons that have run back and been derailed at runaway catch-points credit must be given to English railway engineers. The sand drag in Germany was the result of an accident in October, 1890, on a 1 in 55 gradient at the Nieustadt Station, Dresden, after which Dr. Köpcke took out Imperial patent No. 65,623 of 1891 for the idea. Seeing recently in the *Great Western Railway Magazine* for 1917 that there was a sand drag in use many years ago at Hayle, in Cornwall, we communicated with Mr. Felix J. C. Pole, the general manager, and by his assistance and the co-operation of Mr. W. W. Grierson, the chief engineer, and Mr. H. D. Smith, the divisional engineer at Plymouth, we find that it was used as long ago as 1877, but that the drag was not to stop trains out of control, but wagons that broke away when ascending the bank of 1 in 36, and so prevent them running back into the river. The first sand drag of the German type used in this country was installed at Accrington, on the Lancashire and Yorkshire Railway, after a goods train had, on April 27th, 1905, got out of control when descending the Baxenden incline of 1 in 40.

Small Steel Castings.

(*Contributed.*)

The starting of a foundry for the production of small steel castings presents many difficulties by reason of the many different factors in the problem which have to be taken into consideration. For example, electric steel, by virtue of its freedom from gases and great purity, together with its high pouring temperature, seems well suited for the making of very thin and light castings, especially so if the steel is run directly from the furnace spout to the moulds. Furnaces of 1-ton capacity are possibly the most suitable size. Compare this proposal with the crucible process, which is also suitable for the purpose in view. The pots are usually of about 90 lb. capacity—larger pots have generally been abandoned. The steel can be obtained exceedingly hot, fluid, and free from gas, and if a proper selection of the raw metals is made the resultant steel is as free from impurities as electric steel. The making of very thin section castings present no difficulty.

A very small electric furnace would be necessary were it desired to pour the whole contents economically with the furnace at its highest temperature. To transfer the whole charge to one large ladle and from it to fill the moulds would be less satisfactory owing to the steel chilling, and the steel would tend to set before the whole charge was cast. On the other hand, the crucibles can be taken straight from the crucible holes, at their highest temperature, just when wanted.

Furthermore, several small electric furnaces, say, of 1-ton capacity, would be necessary to obtain a large output of exclusively small castings, and the cost of operating small electric furnaces is relatively high. In the crucible process, on the other hand, the weight of metal per pot is standard, and the cost is not affected by the size. Hence a comparison of the two methods may result in favour of the crucible, but there are, nevertheless, particular cases in which the electric furnace has the advantage.

The Bessemer system, with converters up to 1 or 2 tons capacity, also has its advocates, who claim many advantages over the two previous processes for the production of small steel castings, particularly when side-blown converters are used. The total tonnage may be kept down to 1 ton, and the temperature may be made very high if necessary by the addition of high-grade silicon after the initial heat from the original charge has been attained. Small converters, as compared with electric furnaces of similar capacity, could deliver over five times the tonnage in an equal time, and the quality may be as high. The success of the converter primarily depends upon the operator. A skilled blower can be relied upon to put charge after charge into the foundry well up to the schedule. With low sulphur and phosphorus in the charged materials these objectionable elements need not be high enough to influence the quality unduly. Abnormally low sulphur and phosphorus can, of course, be obtained in the electric furnace, but it is only rarely that such extreme purity is required, and at a cost which purchasers will only pay in exceptional circumstances.

The usual bottom-blown Bessemer and side-blown converter produce similar qualities of steel. Generally the side-blown converter produces the more fluid steel for small work, but the refining losses are from 5 to 10 per cent. greater than in the bottom-blown converter. It is generally supposed that the "blown" process always absorbs unlimited quantities of oxides. This may occur with over-blown charges, but rarely happens when the process is in the hands of skilled operators. As a matter of fact, with weighed additions of ferro-silicon and manganese, &c., the attainment of specified physical tests and analyses to specifications presents no difficulty.

The usual open-hearth furnace is not so successful for small castings. The extremely high temperature required cannot be obtained consistently without destroying the refractories and generally shortening the life of the furnace. The most successful type of open-hearth for small work is the Siemens special rapid, with a capacity of 1 ton. The producers are built on to the end of the furnace—the flame describing a horseshoe bend before passing back through the same end on the way to the regenerators. The mixture usually charged for a ton heat is as follows:—4 cwt. hematite, 5 cwt. foundry scrap (runners and headers), and 11 cwt. of soft plate scrap. The whole of the charge is rapidly melted until the bath is fluid. Samples for carbon estimation may be taken, but it is usual to adjust the amount of hematite to give the desired carbon. The ferro-silicon and manganese are allowed to melt on the banks and run down into the bath. The carbon is somewhat high—from .60 per cent. to .80 per cent., and occasionally up to 1 per cent. The steel is poured directly from the furnace. The shanks are piled under the spout and contain about 1½ cwt. each. The furnace is tapped—great care being taken to keep the tap hole and the flow of metal not too large. The shanks are lifted away one by one as they fill, the steel running into the one underneath. The tap hole is stopped with a hard, dry cone of ordinary foundry floor sand mixed with plumbago and coal dust, which is hand-rammed in a metal cone box. The cones fit into a recess on the end of the stopping rod. The furnace tap hole may be opened and closed many times in the course of a heat, the steel being kept hot in the furnace in the meantime. The refining losses are small, but high carbon, instead of higher temperature and lower carbon, condemns this process for many classes of small castings. This type of furnace, however, has been used extensively with great success for the production of colliery castings. The steel with low carbon is too sluggish and cold for casting small work, but with the addition of manganese excellent manganese steel can be obtained.

The basic Bessemer and basic open-hearth furnaces are not a success for the production of small castings.

That the old method of crucible steel making can still more than hold its position against modern methods has been clearly proved, and there are large buyers of small castings who have tried all processes but return to their former founders—the crucible steel maker. The quality of crucible steel may be due to the protection of the molten steel from oxidising gases, which is usually exhausted by charcoal addition, and also by the protection afforded the metal by the slag which may be in contact with a neutral atmosphere.

The price of small steel castings is generally governed by the amount of core making, moulding, size, and the difficulty in running, &c. Providing the castings are clean and of ample strength for their proposed use, analysis is rarely called for. Special prices are paid for alloys and special carbon castings, but there is only a very small demand for these things.

Generally speaking, the very costly and expensively operated plants cannot ensure any higher price for their products on the recommendation of slightly lower sulphur and phosphorus. Specialist can obtain high prices, but steel founders are not all specialists. They have to consider their various inquiries carefully in view of their own risks and their competitors' prices.

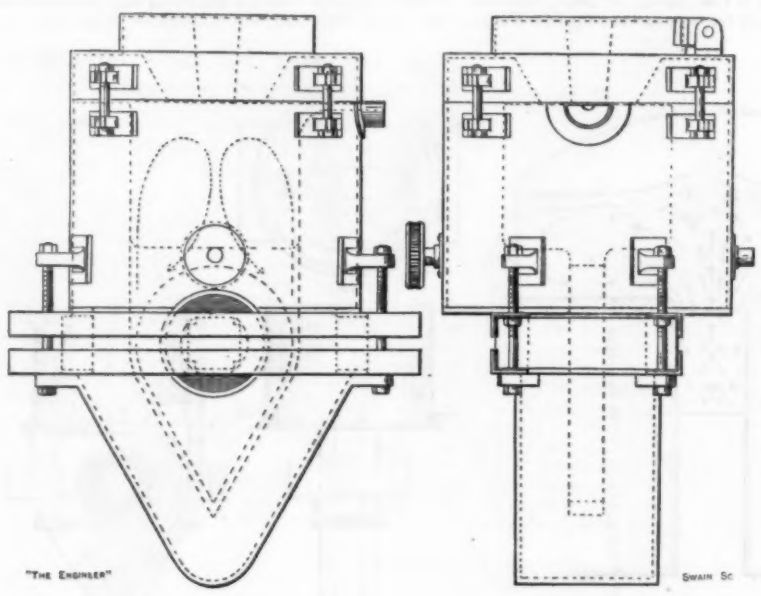


FIG. 3—ARRANGEMENT OF AJAX-WYATT FURNACE

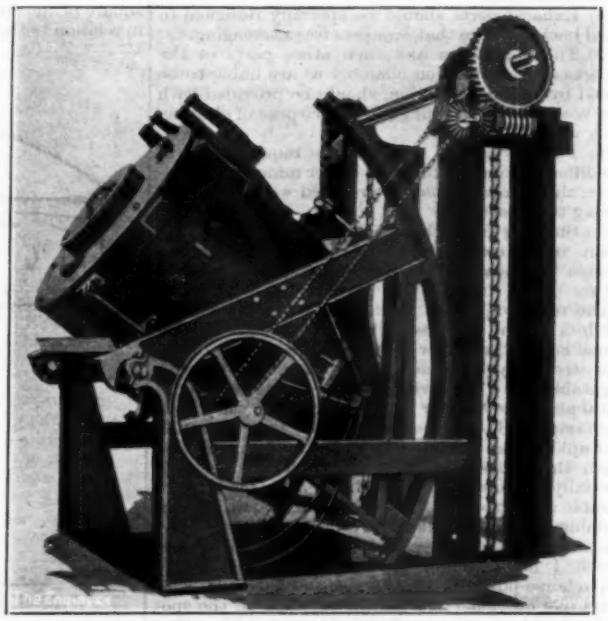


FIG. 4—LATEST FORM OF AJAX-WYATT FURNACE

According to the Board of Trade returns, the value of the railway material exported during May was as follows, the corresponding figures for May, 1920, and May, 1919, being added in brackets:—Locomotives, £3,109,568 (£1,862,418, £365,496); rails, £1,765,102 (£733,072, £601,876); carriages, £668,093 (£607,898, £129,806); wagons, £2,682,351 (£2,414,439, £389,271); wheels and axles, £980,950 (£815,008, £162,162); tires and axles, £696,948 (£527,199, £372,249); chairs and metal sleepers, £714,264 (£283,622, £87,033); miscellaneous permanent way, £1,319,464 (£953,262, £318,046); total permanent way, £5,613,725 (£3,343,642, £1,026,142). The weight of rails exported was 80,146 tons (40,835 tons, 36,884 tons); and of chairs and metal sleepers, 29,008 tons (13,556 tons, 5254 tons). During May, 1921, locomotives to the value of £108,093 were shipped to South Africa, £383,573 to India, and £45,320 to the Straits Settlements. Rails to the value of £72,976 were sent to the Argentine, £58,719 to India, and £25,375 to Ceylon.

A Seven-Day Journal.

International Naval Estimates.

At a moment when the naval policy of Great Britain and the laying down of the four new capital ships has been under discussion in Parliament, more than ordinary interest attaches to the official statement showing what are the naval estimates of the Great Powers. This information, which has been given by the Financial Secretary of the Admiralty, compares the naval estimates of the United States, Great Britain, France and Japan for the financial years 1913–14 and 1920–21 respectively, the figures for the first-named period being converted into sterling at par rate of exchange and for the second year at average rates of exchange. The expenditure of Great Britain for the two years estimated on these bases is £48,800,000 and £90,800,000, for the United States £29,200,000 and £134,450,000, for Japan £10,700,000 and £48,800,000, and for France £21,300,000 and £16,600,000. The figures provide food for careful thought as to future policy.

Ministry of Munitions Bonuses.

It appears to be generally agreed that the famous 12½ per cent. bonus to engineers and the subsequent extension of it or an equivalent gift to many classes of workers will automatically lapse on September 1st. It is not regarded as likely, however, that there will be any trouble in connection with its discontinuance. The subject has already been discussed at conferences of employers and employed, and there is every indication that the instalment plan of reduction can be arranged without causing an industrial breach. There is a growing realisation, even among those in the ranks of labour, that wages must be reduced if Great Britain is to maintain her position in the engineering trades; but the situation is, it need hardly be said, gravely complicated by the fact that there has not been such a fall in the cost of living as would justify from that standpoint the wages reductions which are essential if we are to maintain our position in international trade. A Grantham firm has made suggestions to its men that the need of further wages reductions might be obviated by the introduction of a forty-seven-hour in place of a forty-four-hour week and modifying the rules in connection with payment for overtime.

Shipyard Wages.

Important meetings were held at Glasgow on Tuesday and at Edinburgh on Wednesday, with the object of settling the disputes with shipyard joiners and other branches of labour engaged in the shipbuilding and allied industries. The Glasgow meeting was the first sitting of the Board of Arbitration appointed under the Industrial Courts Act to inquire into questions which have arisen between the Shipbuilding Employers' Federation and some of the trade unions. Only claims affecting the Scottish industry were discussed on Tuesday, the intention being that the case of the English districts shall be investigated at a sitting of the Board in Newcastle later in the month. The Shipwrights' and the Boilermakers' Unions are mainly responsible for the trouble which has arisen. The fresh attempt at the Edinburgh meeting on Wednesday to settle the joiners' strike has failed. Unfortunately, the employers were not able to make any fresh offer, and it is generally admitted that they have explored every avenue which might lead to the return of the joiners to the shipyard. The strike will therefore continue.

Mid-Scotland Ship Canal.

Fresh attention is being given to the construction of the Forth and Clyde Ship Canal. The subject is to be discussed at the forthcoming meeting of the British Association at Edinburgh, and meanwhile Mr. Robert Bird, secretary of the Mid-Scotland Canal Association, has placed before the Board of Trade statistics which, it is believed, would justify the construction of the canal from the traffic standpoint. The attitude of the Board of Trade is that it is very difficult to arrive at a reasonably accurate estimate of the amount of shipping which would be likely to use the canal. It is agreed that in connection with coastwise traffic the canal would afford the greatest advantages to commercial shipping, but the Board of Trade officials are not satisfied that the estimates put forward by the Mid-Scotland Canal Association are sufficiently reliable to be accepted as a valid argument for the commercial success of such a canal.

Government Airships.

At the eleventh hour, the intention to scrap the Government airships in default of an offer from a commercial company to take them over has been deferred. There will be general agreement that the decision taken as the outcome of a conference on Tuesday last of the Prime Ministers of the Dominions with our own Government is a wise one. With the report of the expert committee before them, official representatives of the Home and Dominion Governments could not lightly reject the suggestion that something should be done under Government auspices to utilise the airship fleet for the improvement of Empire communications. Those who were responsible for the threat that the airships would be scrapped and the *personnel* dispersed, probably had their opinions modified by the report of the Committee, and hence the determination to defer the dissolution of the Airship Department. It is going to cost a good deal of money even to do experimental work in ascertaining what can be done to establish Empire air services, and the Dominion Premiers have naturally asked for time to consult Overseas Parliaments before committing their Governments to expenditure in this connection. Nothing definite will be done, therefore, for some months, and meanwhile it is hoped that a practical scheme may be evolved.

Buckie Harbour Works.

After having been in progress for a period of ten years, the improvement scheme at Buckie Harbour is now practically completed. It will be recalled that new basins were opened in the early part of the year 1917, and the deepening of the entrance channel completed last year, but it is only now that the new north breakwater, 2350ft. in length, has been completed. The design adopted for the breakwater is that of concrete blocks varying in weight from 7 to 10 tons set on a rubble core. There is still some work to be done in the further deepening of the entrance channel. The harbour should provide the necessary accommodation for the fishing industry for many years to come.

Iron and Steel Trade Outlook.

Things might be worse in the iron and steel trades than is actually the case. A well-known member of the National Federation has given a reminder that while production in this country practically ceased during the coal strike foreign competitors were also having a difficult time, and a recovery is not yet in sight. In the United States and Belgium production has fallen to a very low level, and the same is true to a lesser degree of the French industry. In Germany, although no definite figures are available, it is understood that works are operating on a scale much below full capacity. Nor is it only the fact that output has fallen off; there has been a distinct hardening of prices, and it has not been possible for foreign competitors to transact a large trade abroad. The chief problem which the home industry has to face is the price of coal. To be able to operate at a profit coal must be available at lower prices than those now ruling. The wages question is being handled satisfactorily.

Road Transport Developments.

Spurred by the competition of railways during the holiday this week, road transport interests are making vigorous efforts to cater for the public on new lines. It is recognised that weather conditions this summer have been extraordinarily favourable to the development of passenger traffic by road, and that plans must be made not only for the winter season, but for more normal climatic conditions. Experiments are now being made with the carriage of parcels at lower rates than those now charged by the railway, and it is understood that some of the large passenger transport companies intend to convert some of the passenger vehicles into goods vans and inaugurate regular services between London and provincial centres. A special attempt would be made to divert from railway to road the higher-rated classes of traffic, and a period of strenuous competition is clearly in prospect.

New Thames Tunnel.

The deputation from public bodies interested which waited on the Minister of Transport yesterday was able to present a strong case for the construction of a tunnel beneath the Thames at Gravesend to link up the railway systems north and south of the river. The scheme which it outlined is for a tunnel 2¾ miles, of which ¾ mile would be under the Thames at a depth of about 70ft. from high water level. It would be connected on the southern side with the South-Eastern and Chatham system, but on the northern bank of the river a new line of railway would be constructed, making a junction with the Midland system at Pitsea, and being linked to the Great Eastern at Ingatestone and Sawbridgeworth, the Great Northern at Stevenage or Hitchin, the London and North-Western at Luton, and the Midland at Bedford. The cost of construction of the tunnel and the new railway is estimated at £6,000,000. The scheme is supported, not only by a large number of local authorities in Kent, Herts and Essex, but by the Port of London Authority. It is argued that, apart from the strategic value of the proposed railway, which is admitted, it would, by opening up a direct route through the Kentish ports between the Continent and the Midlands and the North, confer great advantage on the industrial and trading community. Under existing conditions, all this traffic has to pass through the congested London railway area.

The New Capital Ships.

The critics of the naval policy of the Government made a somewhat poor show in the debate on the Naval Estimates on Wednesday. With regard to the four new capital ships, for which tenders are to be invited from private firms, Mr. Amery, the Financial Secretary to the Admiralty, very justly said that our policy in building them contains no element of provocation or challenge. He was, on the advice of his experts, equally emphatic that the capital ship, and not the capital aircraft or the capital submarine, remains the basis of naval warfare. He reminded the House of Commons that the fighting fleet of the future is a collection of highly diversified and specialised units, each of which is indispensable to the defensive and offensive *rôle* of the whole. There was an air of great frankness in the statement that the new ships will be battle-cruisers of the "Hood" type, with improvements upon that vessel in protection and armament. In view of the fact that all American and Japanese capital ships which have been laid down since the Hood have been equipped with 16in. guns, the new British vessels will be similarly armed. Mr. Churchill made a spirited defence of Government policy. It was not for this country, he intimated, to allow its sea power to fall to a point at which we might be tempted to make, or be forced to make, compromising or entangling agreements in the desperate hope of supplementing our own strength by that of others.

Coal Output.

There has been a steady increase in the quantity of coal raised since the resumption of work. For the week ended July 9th, the total was 2,352,000 tons, whereas for the week ended July 23rd it was 4,331,800 tons, which compares with 4,282,000 tons for the corresponding week of 1920. High-water mark has not yet been reached, it being represented by the figure of 5,307,000 tons which was recorded for the week ended December 18th last. The totals for recent weeks must, however, be regarded as satisfactory, as they must be viewed with the fact in mind that numbers of pits which were working up to the time of the strike have not been reopened. The pits in which coal raising has not yet been resumed number 131, and under normal circumstances find employment for 25,629 men. In addition, there are 93 other pits normally employing 29,000 men, in which no coal was wound up to July 23rd. These, however, should be put in the productive list almost immediately.

Arctic Exploration by Aeroplane.

A natural development of the greater reliability of the aeroplane is the decision of an American physicist, Mr. E. F. Naulty, to make a flight over the North Pole in September. The machine, which has been specially constructed for the trip, has been designed to carry fuel for a 50 hours' continuous flight at a maximum speed of 100 miles an hour. Three men will accompany the aviator. The route to be followed will be from Point Barrow, in Alaska, *vid* Spitzbergen and North Cape, and it is hoped to make several landings during the flight, although it is believed that the machine would be capable of covering the whole distance of 1500 miles between Point Barrow and Spitzbergen in a continuous flight. Plans are in the making to continue the flight from North Cape *vid* Scandinavia to London.

Ship Repair Work for Portsmouth.

Much satisfaction has been expressed at the news that the White Star liners Arabic and Suevic, as well as two troopships, have been assigned to Messrs. Crampton's yard at Portsmouth for re-fitting operations. Work on these ships will extend over many weeks, and should materially alleviate the unemployment which has reached a somewhat acute stage in the dockyard town. Difficulties have arisen during a recent period in connection with the joiners' strike, which has not only driven work away from Portsmouth into continental yards, but from Southampton. It is understood, however, that no hitch is likely to take place over the re-conditioning of the liners named, although it is not stated what attitude the local joiners are likely to take up. The hope that this prolonged strike would be ended has not been fulfilled.

Developments in Power Station Design.

No. III.*

THE Fuller pulverised coal system, which has been installed in various American power stations, differs materially from the Holbeck system described in our issue of July 22nd. The first operation after the coal has been delivered from trucks into the hopper A—see Fig. 5—is, as usual, to crush the coal by means of a crusher C, which is fed by means of a shaker feeder B. After leaving the crusher, the coal is delivered to the boot of a steel-encased elevator D, arranged to discharge the coal on to the belt of a magnetic separator E, which, as usual, serves to remove "tramp" iron from the coal before it reaches the pulveriser. Having passed over the magnetic separator, the coal drops into a steel bin F, erected above the rotary coal dryer G. This dryer, which is shown separately in Fig. 6, consists of an inclined longitudinal shell fitted with rollers and gearing to enable it to be rotated on its longitudinal axis, the interior of the shell being fitted with lifting shelves designed to raise the coal and drop it uniformly across the interior. The latest type of dryer is usually fired with pulverised coal, and combustion takes place around the outside and underneath the dryer shell, the burner for the dryer furnace being shown at T in Fig. 5. The hot gases pass through a short flue to a discharge head and then up through the dryer, and are finally drawn off by an exhauster fan V into a cyclone collector W, which collects any fine coal that may have been picked up and carried off, owing to the velocity of the gases in the interior of the shell. The powdered fuel is supplied to the burner T by a screw feed S, whilst the air supply for the dryer burner is provided by the fan U. R is the dryer furnace bin, and Q a coal pipe, which delivers the pulverised fuel to this bin. Dryers fired in accordance with this principle are claimed to reduce the temperature of the gases at the point where they come into contact with the coal being dried, so that the volatile content of the coal is not driven off, and so that there is no possibility of any flame coming into direct contact with the coal being dried, and all risk of fires occurring are avoided.

Another object aimed at in the design of this dryer is to utilise the heat of combustion around the outside of the shell, and within the combustion chamber with a minimum radiation loss. The exposed surface of the shell and the length of the flue connecting the combustion chamber to the discharge hood have been reduced to a minimum, and a maximum drying capacity is obtained with a minimum amount of fuel. The driving mechanism, it will be noted, is placed at the feed end of the shell, and the dryer may either be driven from a line shaft or by an independent motor. At the feed end of the dryer a cast iron end is fitted for the purpose of connecting up the exhaust fan V, and the feeder is arranged so that the amount of coal fed into the dryer can be adjusted at will. The dried coal is carried up by a coal elevator H to a screw conveyor J, which delivers it into the dry coal bins K, which discharge into Fuller Lehigh pulverisers L. The feed to these pulverisers can be regulated at will.

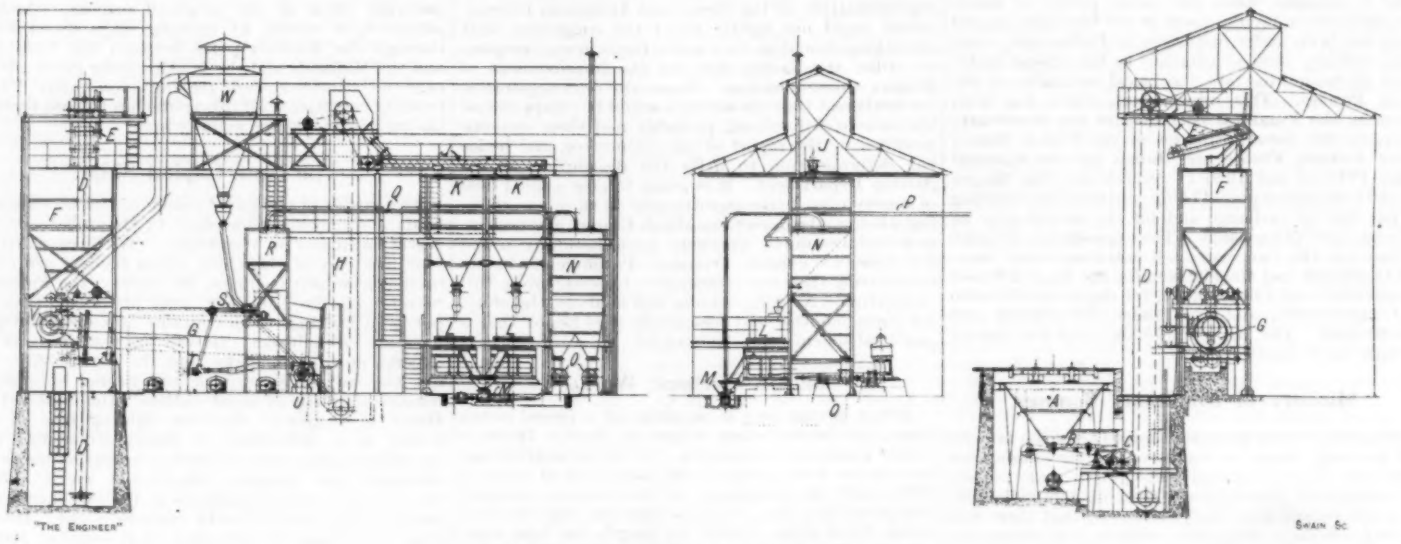


FIG. 5—A FULLER TWO-MILL PULVERISED FUEL PLANT

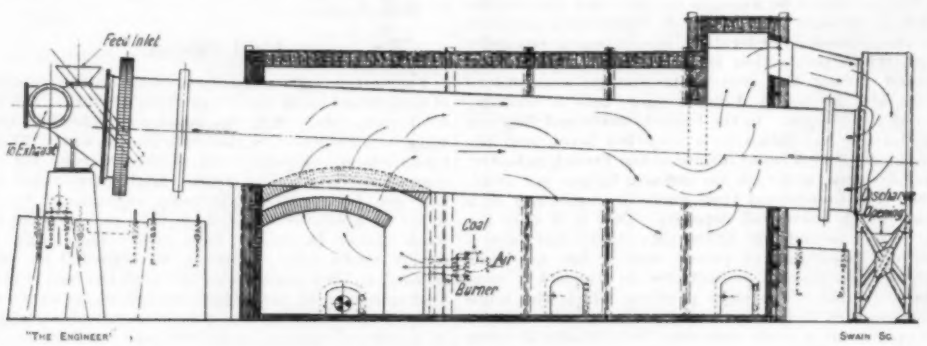


FIG. 6—THE FULLER COAL DRYER

The pulverising element of the most usual type of pulveriser employed in the United States consists of four unattached steel balls, which roll in a stationary horizontal concave-shaped grinding ring, the balls being propelled around the grinding ring by means of four "pushers" attached to four equidistant horizontal arms forming a portion of a yoke which is keyed to the mill shaft. The material discharged by the pulveriser feeder falls between the balls and the grinding ring in a uniform and continuous stream, and is reduced to the desired fineness in a single operation. The mill is fitted with two fans, one operating in the separating chamber immediately above the separating zone, whilst the other works in a fan housing immediately below the pulverising zone. The upper fan lifts the fine particles of pulverised material from the grinding zone into a chamber above that zone, where the fine particles are held in suspension, whilst the lower fan acts as an exhauster and draws the finely divided particles through the finishing screen, which completely encircles the separating chamber. The material leaving the separating chamber is drawn into the lower fan housing, from which it is discharged through the discharge spout by the fanning action of the lower fan, all the material discharged from the mill being finished product, and requiring no subsequent screening. Air, induced by the action of the lower or discharge fan, passes over the pulverising zone and out through screens surrounding the separating chamber, so as to ensure cool operation and maximum screening efficiency. This current of air keeps the screen perfectly clean, and enables the pulverising mill to handle material containing a considerable amount of moisture without in any way affecting the efficiency of the machine. As soon as the coal is reduced to the desired fineness, it is lifted out of the pulverising zone and discharged from the machine, with the result that the crushing force is only applied to a limited amount of coal at a time, and the power required to operate the machine is reduced to the lowest possible value.

Referring again to Fig. 5, it will be seen that the pulverised coal is delivered to the storage bin N by means of a coal pump M, which is driven by an electric motor, whilst other pumps O beneath the separator serve for delivering the coal throughout the system. The coal can, however, if desired, be supplied direct from the pump M by way of the pipe P.

The only moving part of the pumps is the helix, which receives the pulverised coal and delivers it directly to the pump line. Compressed air is admitted to the system at the point where the pulverised coal is discharged from the pump barrel into the pipe line, the function of the compressed air being to render the stream of pulverised coal in the pipe line sufficiently fluid to make it flow through the pipe whilst assisted by the propeller action set up by the

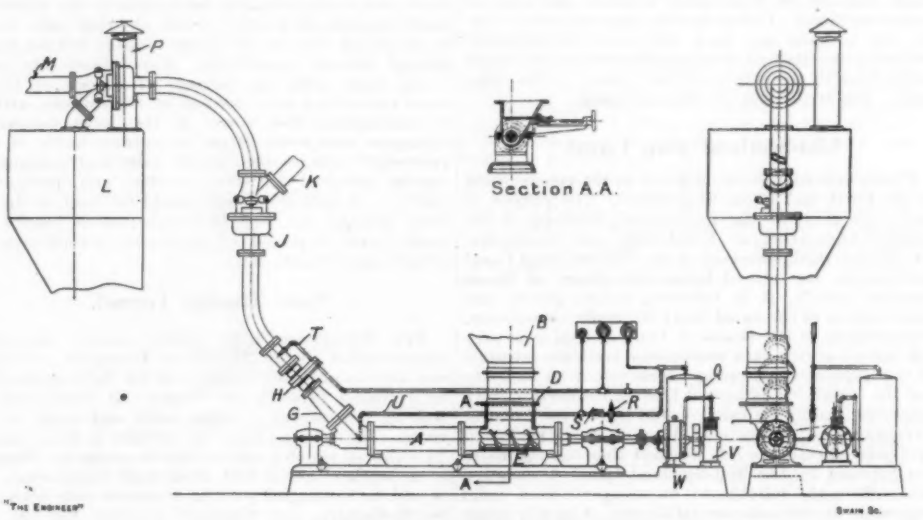


FIG. 7—A PULVERISED COAL CONVEYING SYSTEM

* No. II. appeared July 22nd.

forward thrust of the helical pump. The pipe line may be provided with valves to permit discharging the pulverised coal into the bins at any intermediate point in the system, or if desired the pulverised coal may be diverted from the main line to branch lines, serving other portions of the plant. The drawing—Fig. 7—which is almost self-explanatory, shows the conveying system used in conjunction with the pulverised fuel plant at the works of the Newton Steel Company, Newton Falls, Ohio. A is a 6in. Fuller-Kinyon pulverised coal pump, B the bin in which the pulverised coal is placed, D the pump hopper, E the forcing worm, G a reducing nozzle, H a diverting valve, J a two-way valve, K a branch conveyor pipe, L a receiving bin, M a continuation of the main conveyor pipe, P a vent pipe for the receiving bin L, Q the compressed air receiver, R a pressure-reducing valve, S an ordinary air valve, T a conduit clearing pipe, U the aerating pipe, V the air compressor, and W the driving motor. The advantages claimed for this conveyor system may be summarised as follows:—(1) The simplicity of the coal pump makes the initial cost of the system very small, and as wrought iron pipe is used for the conduit and as bends may be used, the labour cost of the installation is very low and heavy structural supports are eliminated. (2) The small amount of air introduced for aerating purposes does not approach, even in the remotest degree, the amount necessary for combustion, and there is consequently no risk of fires or explosions. (3) The power consumed per ton of material moved is very low, and the wearing parts are reduced to a minimum. As the conduit is composed of standard wrought iron pipe, the connections can be made perfectly tight, with the result that the system is absolutely clean. (5) By installing a weighing bin above the pump, the coal delivered to this bin, and, in turn, to any particular furnace, can easily be measured. The total power required per ton of coal varies between 1.3 and 1.8 horse-power, and the air required is approximately 6 cubic feet per cubic foot of coal, whilst the air pressure varies from 15 lb. to 30 lb. per square inch, depending upon the length of the line and the lift.

The Fuller Engineering Company has recently developed a pulverised coal bin indicator, which consists of a cylindrical casting equipped with two diaphragms, which are fitted at the top and the bottom of the bin, and the action of the coal against the diaphragms either makes or breaks an electrical contact, which operates, in turn, a lamp or bell, thus indicating whether the bin is full or empty. The system eliminates the possibility of overfilling, and also the possibility of bins running short of coal. In most of the recent pulverised coal plants installed by the Fuller Engineering Company, matters have been arranged so that the pump in the coal house can be immediately stopped by the bin attendant at the furnaces. When electrical indicators are fitted to the bins in the manner described, the bins may be sealed up, the only opening necessary being that connected to the vent pipe, which projects through the roof of the building. The drawing—Fig. 8—shows four standard types of boilers fired with pulverised coal in accordance with the Fuller system. From the overhead hopper the coal drops by gravity into the feeder, and it then passes into the lower horizontal pipe to the burner, where it joins the air blast and is projected into the furnace. These four illustrations show boilers of different types equipped with the horizontal type of burner designed for firing high volatile fuels, namely, bituminous, sub-bituminous and semi-bituminous and lignite, or, in fact, any grade of coal in which the volatile content on a combustible basis exceeds 20 per cent. With these fuels the greatest efficiencies can be obtained by firing the boiler in a horizontal direction, and the necessary volume of the combustion chamber is reduced to a minimum. The design of a suitable combustion chamber is the most important feature of a boiler installation, where pulverised coal is to be used. The distance from the burner tip to the bridge wall must be great enough to avoid the bridge being subjected to a blow-pipe effect. There must also be a sufficient combustion chamber volume for the quantity of fuel to be burnt per unit of time, as well as a suitable arrangement of the areas, so that the velocity of the gases will at no time exceed 10ft. per second when passing refractory surfaces, in order that the pitting or melting away of furnace walls may be eliminated.

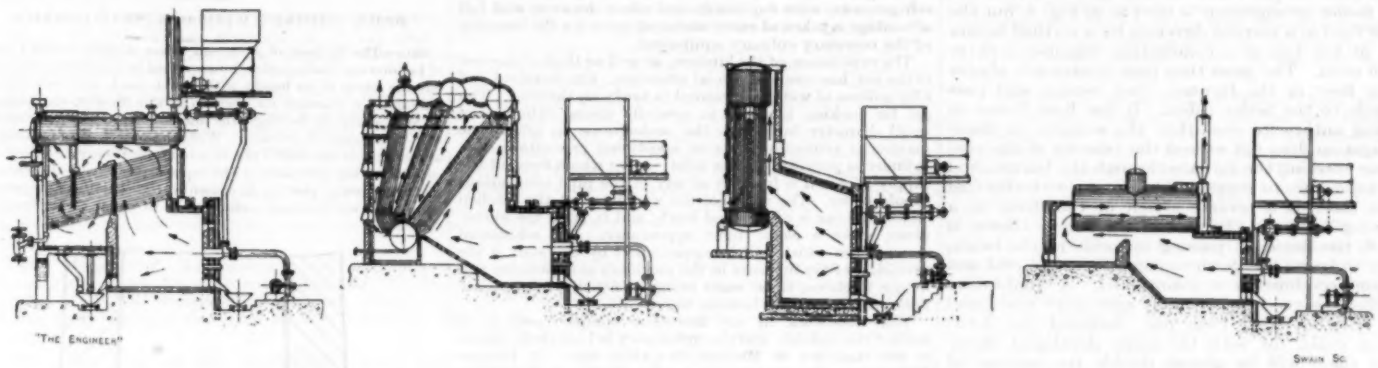


FIG. 8—FOUR TYPES OF BOILER FITTED WITH HORIZONTAL BURNERS FOR PULVERISED BITUMINOUS COALS

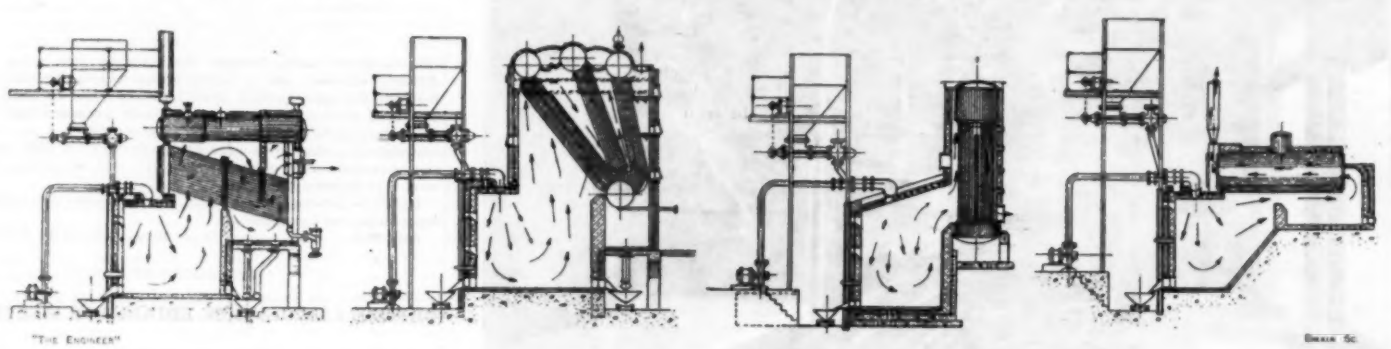


FIG. 9—FOUR TYPES OF BOILER FITTED WITH VERTICAL BURNERS FOR PULVERISED ANTHRACITE

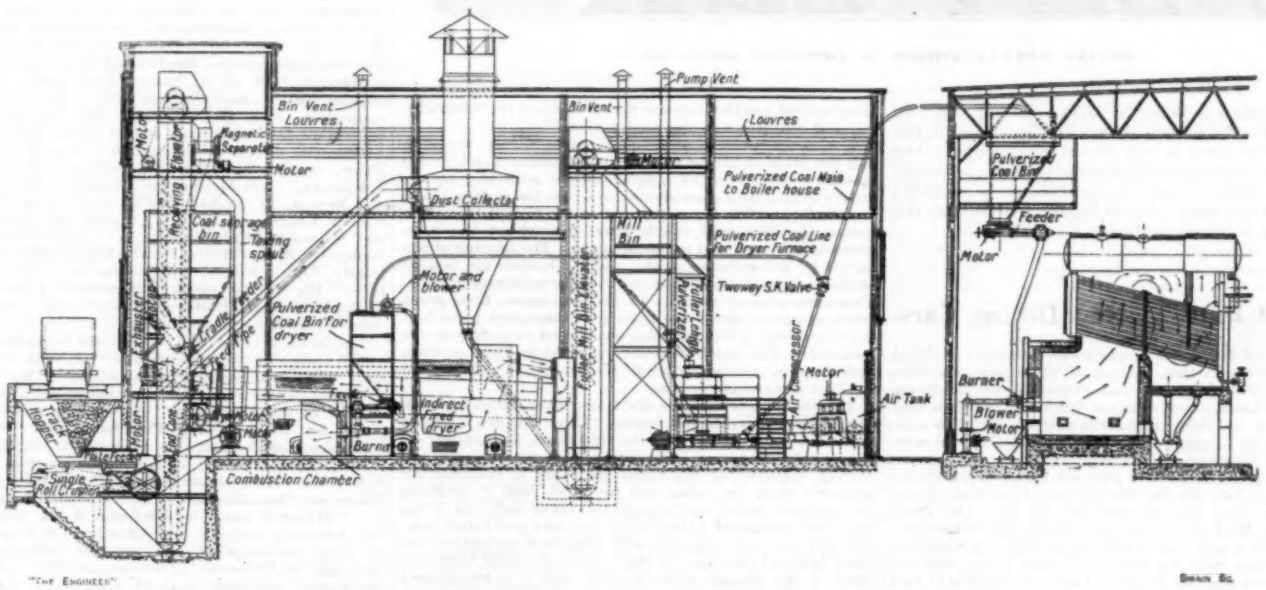


FIG. 10—A COMPLETE PULVERISED COAL PLANT FEEDING A BABCOCK BOILER

It is to be noted that in the case of each of the arrangements shown in Fig. 8, openings are provided for cleaning out the furnace.

In Fig. 9 the same types of boilers are shown as in Fig. 8, but the burning equipment in the former case is arranged for firing low volatile coals, such as anthracite and semi-anthracite, &c., or any fuel in which the volatile content on a combustible basis is less than 20 per cent. It will be noted that the same feeder arrangement is used as in Fig. 8, but the coal is fired in a vertical direction by a vertical burner fixed at the top of a combustion chamber arch or Dutch oven. The gases then pass downwards almost to the floor of the furnace, then reverse and pass upwards to the boiler tubes. It has been found in burning anthracite coal that the velocity of flame propagation does not exceed the velocity of the coal and air entering the furnace through the burner, and it is impossible to support combustion with this fuel unless there is a reverse action of the flame or a reversing arch. In the case of the boilers shown in Fig. 9, the flame, in passing upwards to the tubes, serves to ignite the downcoming mixture of coal and air, and combustion is maintained. A combustion chamber designed for burning anthracite coals and coke will be larger than one designed for bituminous coals, for with the same developed horse-power there will be almost double the amount of gases in the furnace. The areas of the various "passes" and flues, however, will be the same in both cases. It is quite practical to burn bituminous coal in a furnace designed for burning anthracite coal, but the radiation losses will be slightly greater.

A complete pulverised coal plant supplying the fuel to a Babcock boiler is shown in Fig. 10. In common with the boilers shown in Figs. 8 and 9, the coal from the plant is fed into a hopper above the boiler, and is supplied to the burner by a motor-driven screw feed, while the air for combustion is provided by a small electrically driven blower mounted at the floor level in front of the boiler.

MIDLAND RAILWAY—KITCHEN IN FIRST-CLASS DINING CAR

Midland Railway New Dining Cars.

The Midland Railway Company has recently completed at its Derby works the building of three new first-class dining cars with kitchens, and three third-class dining cars, for the London and Glasgow service, into which they were drafted on July 11th, running on the 9.35 a.m. St. Pancras to Glasgow (St. Enoch) and the 9.20 a.m. Glasgow (St. Enoch) to St. Pancras.

The new cars, interior and exterior views of which are given on page 146, are the first to have been built in the Derby shops since the appointment, on May 1st, 1919, of Mr. R. W. Reid as carriage and wagon superintendent, and they strike a new note in railway carriage construction.

The first-class cars are 65ft. long over body, and are mounted on six-wheeled bogies. Each car consists of two dining saloons—accommodating twenty-two passengers—a lavatory and luggage locker, a kitchen, two pantries and separate toilet arrangements for the staff. The kitchens in these cars—see the accompanying illustration—are larger than are usually found on railways in this country, and special attention has been given to making them as convenient as possible for serving the maximum number of meals in what is, after all, a very limited space. There is a large stove with double ovens, gas rings for boiling pots, with over them the grills, and over the latter the hot water boilers. The kitchen is also provided with a special rapid-heating boiler for providing the hot water required for teas. There is also a hot plate oven, in which some hundreds of plates can be heated at once, and on the top of this oven the joints may be kept hot whilst they are being cut up. Two large wash-up sinks, a refrigerator, nests of drawers for condiments, and ample space for carrying the usual equipment are provided. The walls of the kitchen are lined with aluminium, and the floor is covered with sheet lead, on the top of which are fixed hard wood grids. The butlers' pantries are fitted up with small wash-up sinks, and provided with hot and cold water, refrigerators, wine cupboards and silver drawers, and full advantage is taken of every corner of space for the carrying of the necessary culinary equipment.

The ventilation of the kitchen, as well as that of the rest of the car, has received special attention. One hundred and fifty gallons of water are carried in tanks on the roof. The gas for cooking is stored in specially strong cylinders of small diameter built into the underframe to afford the maximum protection. As an additional precaution each cylinder is provided with a safety valve which cuts off the supply of gas if a fracture of any of the pipe connections should occur. The whole of the woodwork at the kitchen end of the car is of polished birch, and it, with the aluminium, gives a clean, light appearance. An additional convenience which will be appreciated by the staff is the provision of tip-up seats in the corridors and pantries and in the kitchens, these seats being so fitted that they are flush with the sides when out of use.

The woodwork in the first-class compartment is of walnut throughout, and the upholstery is blue cloth, which is the standard in Midland first-class cars. A Belgian Wilton carpet and rugs cover the floor. A distinctive feature of the first-class cars is the employment of the oval in decoration, both in the large panels in the doors between the compartments and in the roof decoration, also in the frames for the pictures, mirrors and so forth. The mouldings and decorations have been kept as simple as possible to give facilities in cleaning. The lavatory compartments have special marbled cement floors, and are provided with hot and cold water in the wash basins.

The cars are electrically lighted entirely from the roof, and the style of fitting which is employed is novel in this country. It consists of a square stand with four square arms carrying opal glass shades on which the square design is carried out. The lamps themselves are 25-volt 12 candle-power gas-filled, and the lighting throughout the compartments is even and free from glare. The heating of the cars is by low-pressure steam, and the heaters are housed on the side walls and protected by an ornamental grating. This arrangement permits of the maximum floor space being available under the seats for passengers' hand luggage, and that point was also considered in designing the seat ends. The usual racks are provided for light articles, and they, in common with all the fittings in the car, are finished in Venetian bronze.

The third-class cars are 59ft. long over body, and are mounted on four-wheeled bogies. These cars are intended to run in conjunction with the first class, the kitchen on the former supplying both cars. As a consequence the seating capacity of the third-class cars is considerably greater; forty-two seats are provided, and in addition there are a lavatory and luggage lockers at each end of the car. The woodwork in the third-class cars is of fumed oak, and the seats are trimmed with Baghdad moquette—the usual Midland pattern. In this car the diamond forms the basis of the scheme of decoration, and it is reproduced in the sliding doors, picture frames, and on the roof. The floors of these cars are covered with linoleum, and have a centre strip of horsehair carpet. The arrangements as regards the lighting, heating and the lavatory compartment fittings are the same as have been described for the first-class cars.

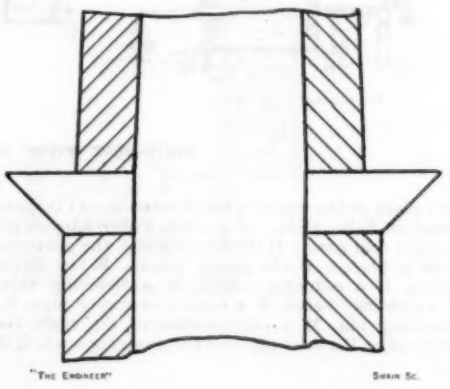
All the cars are fitted throughout with the vacuum brake, and by an ingenious method of variable leverage the heavy cars are braked to their full capacity without necessitating the introduction of a larger size of brake cylinder. The springing of the cars has received very careful consideration so as to make the riding as smooth as possible, and special precautions have also been taken to deaden sound by the insertion of insulating material between the floors and sides.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

BRICK CHIMNEY WITH CONCRETE CORNICE.

Sir,—The by-laws of a certain urban district in the County of London say that a boiler chimney shall be constructed throughout the whole of its height with sound, hard, well-burnt bricks. I designed a chimney for erection in this district, the height to be 80ft. above the footings, the lowest 20ft. to be square on plan and the remainder circular. With the object of improving the appearance of the shaft I placed a reinforced concrete ornamental cornice at the junction of the square portion of the chimney and the circular portion as shown in the sketch. This was not considered by the local authority to be equal to brickwork in



constructional value, because the contends that when two different materials are in juxtaposition with a straight joint between, the upper portion of the chimney might be blown off. The local authority has, however, kindly conceded that if a precedent can be found for such similar construction, *i.e.*, some material other than brick carried through the whole thickness of the brickwork of a chimney shaft, he will recommend his council to approve of my plan.

I shall be greatly obliged if any of your readers can acquaint me with any such example.

July 29th. D. J. Moss, A.R.I.B.A., M.S.A.

BRITISH ASSOCIATION, EDINBURGH MEETING

The preliminary programme of the Edinburgh meeting of the British Association was issued in the middle of this week. The inaugural general meeting will be held in the Usher Hall, on Wednesday, September 7th, at 8.30 p.m., when Sir Edward Thorpe will assume the presidency in succession to Professor W. A. Herdman, and will deliver an address dealing with "Some Aspects and Problems of Post-war Science, Pure and Applied." On Friday, September 9th, at 8.30 p.m., in the Usher Hall, the first evening discourse will be delivered by Professor C. E. Inglis, on "A Comparison of the Forth and Quebec Bridges, showing the Evolution of Cantilever Bridge Construction during the past Thirty Years." On Tuesday, September 13th, at 8.30 p.m., in the Usher Hall, the second evening discourse will be delivered by Professor W. A. Herdman, on "Edinburgh and Oceanography." The concluding general meeting will be held on Wednesday, September 14th, at 12 noon. Four public lectures to citizens will be given by members of the Association in connection with the meeting. On Tuesday evening, September 6th, at 8 p.m., in the Usher Hall, Sir Oliver Lodge will deliver a lecture on "Speech through the Ether, or the Scientific Principles underlying Wireless Telephony." On Wednesday afternoon, September 7th, at 2.30 p.m., in the Natural History Lecture Theatre, Old College, University, Dr. E. J. Russell will give an address on "Science and Crop Production." On Thursday evening, September 8th, at 8 p.m., in the Usher Hall, Professor A. Dendy, D.Sc., F.R.S., will lecture on "The Stream of Life." On Monday evening, September 12th, at 8 p.m., in the Usher Hall, Professor H. J. Fleure, D.Sc., will discuss "Countries as Personalities."

The sections of the Association will begin their sessions on Thursday morning, September 8th, and will continue daily during the meeting, as arranged by the Organising Sectional Committees. The meeting rooms of the sections will be in the University. Among the addresses to be given by the sectional Presidents are:—Section A: "Problems of Physics," by Professor O. W. Richardson, F.R.S. Section C: "Experimental Geology," by Dr. J. S. Flett, F.R.S. Section F: "The Principles by which Wages are Determined," by Mr. W. L. Hichens. Section G: "Water Power," by Professor A. H. Gibson, D.Sc. The following subjects (among others) will be discussed at joint meetings of the sections indicated:—"The Structure of Molecules" (Sections A, B); "The Age of the Earth" (Sections A, C, D, K); and "The Proposed Mid-Scotland Canal" (Sections C, G).

Our Paris contemporary, *Le Temps*, has collected some figures as to French railway accidents before and since the war. During the present year there have been 43 accidents, involving 54 deaths; last year there were 142 accidents and 122 deaths; and in 1919 107 accidents and 271 deaths. In 1912 there were 209 accidents and 50 deaths, and in 1913 142 accidents and 60 deaths.

Railway Matters.

The Swedish Government has granted permission for the electrification of the Vadstena-Fangelsta Railway.

A sight to which we have not been accustomed for the last seven years was to be seen during the recent holidays. This was the pressing into service of unpainted carriages out of the repair shops.

The number of passengers carried by the railways of the United Kingdom during May was 25.63 per cent. less than in March, *i.e.*, before the coal dispute. The passenger train mileage was 43.2 per cent. less.

The three days devoted to the report stage on the Railways Bill expired on Tuesday evening. Two days are to be given to the third reading, and it is hoped that the Bill will reach the House of Lords on the 10th.

The extent of the works, particularly those for the underground lines, in connection with the Chalk Farm widening of the London and North-Western Railway can now be seen more readily and their importance appreciated.

The French State Railways are about to put a new steamer, the Versailles, into commission as their contribution to the joint service with the London, Brighton and South Coast Railway Company between Newhaven and Dieppe.

What are known as the "Short Lines" in the United States number 500 separate corporations, owning, in the aggregate, about 25,000 miles. They have an American Short Line Railroad Association, and one effort towards more economical working is a consolidated purchasing agency.

It may be remembered that when the war was threatened seven years ago the Territorial Army was in camp and the various units had to be sent home again on the Sunday before the August Bank Holiday of that year. This year the camps have been resumed, and all last week the railway companies were busy carrying the various detachments.

When one considers the size of what may be called the West Coast and East Coast groups, it would seem a pity that the Southern and Western groups have not been combined. From some calculations we have made, the capital on which interest or dividend has to be paid is 158 millions for the Southern Group, 151 millions for the Western, 540 millions for the West Coast, and 270 millions for the East Coast.

During the first three months of the present year the average number of railway servants in the United States was 1,604,713, as against 1,887,220 in the corresponding quarter of 1920, a decrease of 14.97 per cent.; the total hours worked was 858,449,158, a decrease of 22.28 per cent. Owing, however, to the increase in wages made in May, 1920, the compensation paid was only 4.93 per cent. less. This last would be adjusted by the reductions in pay made on the 1st instant.

When the Railways Bill was going through Committee an amendment was carried against the Government that all amalgamation schemes shall be approved by a resolution of both Houses of Parliament. On the report stage the original proposal was restored by 200 votes to 73. Mr. W. Graham said that it was at the instance of the Labour Party that the Government was defeated in Committee, and if the sub-section were deleted the public would lose the protection it gave them.

In the *Railway Signal Engineer* (Chicago) for June appeared a letter from a Honolulu correspondent which gave some particulars of the railways of Hawaii. They were built in 1886, are 9 miles in length, of 3ft. gauge and carry 1,500,000 passengers a year. As yet, no passenger has been killed in an accident. There are forty-three curves, the longest stretch of straight line is 1800ft. in length, and the heaviest gradient is 1 in 50—in favour of the load. The heaviest engine carries 57 tons on the drivers. Oil fuel is used.

Compared with May, 1920, the tonnage of general merchandise carried on the railways of the United Kingdom in May, 1921, was 39.21 per cent. less and the ton-mileage 40.27 per cent. less; of coal, coke and patent fuel the tonnage was 91.27 per cent. less and the ton-mileage 90.53 per cent.; of other minerals the tonnage was 66.6 per cent. less and the ton-mileage 69.75 per cent. less; of goods traffic in general the tonnage was 74.85 per cent. less and the ton-mileage 69.75 per cent. less. The goods train mileage was 60.8 per cent. less.

The railways of the United States have, like our own, made claims on the Government for arrears of maintenance during the two years and two months of Federal control. Against these claims, however, there are counter-claims, and therein is a difference from the conditions here. During Federal control the United States Government spent vast sums on improvements and new equipment, and for these the companies have to pay. As they badly need the money for the arrears of maintenance, they cannot afford to pay the counter-claims, so it is expected that bonds will be issued for the latter.

The Solway Junction branch of the Caledonian Railway extends from Kirtlebridge to Kirkbridge on the North British Company's Silloth branch, and from Abbey Holme, on the latter, to Brayton, on the Maryport and Carlisle. It includes the viaduct across the Solway Firth. This bridge has now been closed owing to the need for repairs, and communication between Scotland and the West Cumberland district has to be through Carlisle. Asked a question about this recently, Sir Eric Geddes said that at one time there was considerable pig iron traffic by this route from the West Cumberland district to places in Lanarkshire, and this traffic, along with iron ore traffic, increased during the war, but has now fallen off entirely. Should such traffic revive it could be worked by way of Carlisle. The renewal of the superstructure of the bridge was under consideration before the war, but it was delayed by that event, and since the Armistice the high prices have been a deterrent. The company will consider the question of repairing the superstructure and reopening the bridge when the present high cost becomes more moderate.

Notes and Memoranda.

In 1886 the Rand was proclaimed as a goldfield, and in December, 1887, the late South African Republic granted Mr. (now Sir) James Sivewright "the right to lay pipes through the streets of Johannesburg in order to supply the inhabitants thereof with water," from a source which he had acquired on the farm Doornfontein. One of the conditions of this concession was to charge not more than £2 per 1000 gals. for any water supplied to the public.

By means of a special method of heating, which has been devised by M. Baille-Barrelle, Sarre coal can be made to yield a coke said to be comparable with the finest cokes from Ruhr coal. The coal is first maintained at a temperature of 320 deg. Cent. for some time; then the temperature is slowly raised uniformly to a final temperature of 750 deg. Cent., or about 200 deg. Cent. below the usual coking temperature. It is also claimed that the by-products obtained are superior to those given by the ordinary coke oven. If the process is successful on a large scale, the Lorraine iron industry will be freed from the necessity of using Ruhr coke.

A device for giving a safe and constant supply of electricity for the operation of electrical toys and models has recently been placed upon the market. This is a small transformer, equipped with 6ft. of flexible cord and a lampholder adapter. Unlike a battery, it is always ready for use, never requires renewal, and, above all, is perfectly clean. The transformers are made in four patterns, all of which, with the exception of the smallest, are provided with control switches on the secondary windings and alternative primary tappings. These two adjustments permit of a wide variation of secondary voltages ranging, in 2-volt steps, from 4 to 22 or 28 volts.

At the Duquesne Works of the Carnegie Steel Company, near Pittsburg, short lengths of billets are taken to the storage bins by a conveyor, and if trucks are not immediately available these bins are filled. When they are emptied the trucks are put to a very severe test, the billets striking their sides with great force. At first much damage was done to rolling stock by this method of handling billets, and the railway companies lodged complaints; they were promptly informed that the method was economically sound, and would not be abandoned, and that the best thing the railway companies could do was to strengthen their trucks. They did, for they realised that in assisting the steel maker they were serving themselves.

A new type of motor lifeboat has just been completed by the Royal National Lifeboat Institution. She is a vessel which has been specially built for experiment at Eastbourne to meet the launching conditions on that part of the coast, and is the only motor lifeboat to be launched from a carriage instead of down a slipway. For this reason she is smaller and lighter than any of the other motor lifeboats built or under construction. The vessel is self-righting, and has a length of 35ft., with an 8ft. 6in. beam. She is fitted for experimental purposes with a Miller engine, to be used as an adjunct to her sails. This engine develops 15 horse-power, and gives her a speed of 5.9 knots. The boat has been built out of the general funds of the Institution, and has not up to the present been named.

In describing, to the South African Institution of Engineers, some experiences with condensers, Mr. T. G. Otley explained how leakage in a condenser having very thin tubes was cured. The trouble, he said, was so relatively serious that they decided to give rubber rings a trial. As it was impossible to obtain the rings of the correct diameter a local firm manufactured lengths of tubing 23 mm. inside diameter and about $\frac{1}{4}$in. thick in 12in. lengths, the tubing being of the finest soft rubber. These tubes were slipped on to a wooden mandril and a special tool holding about 1 doz. safety razor blades pitched $\frac{3}{16}$in. apart was used to cut the rings. No difficulty was found in slipping these over the ends of the tubes; indeed, this method of packing was found to be not only cheaper, but much quicker than those hitherto in use, which generally consisted of stay laces soaked in either tallow or linseed oil. The rubber rings cost about $\frac{1}{2}$d. each.

The Times of July 22nd referred to the discovery in a gravel pit at Swarling, near Canterbury, of a tomb containing implements and vessels of the late Celtic period. The style of the objects, which show characteristic native forms just beginning to be influenced by Roman models, date the grave approximately in the earlier half of the first century A.D. Adjoining the gravel pit, it was reported, the remains of an iron-smelting and enamelling works of the same period were discovered. The facts, however, can hardly be said yet to justify the definite conclusion that the remains were connected with an enamelling works, and indeed there is some doubt as to whether this art was established in Britain at the period to which the discoveries are believed to belong. The supposition appears to have been founded on the existence of a quantity of vitreous slag, but for the present the matter awaits investigation by the Society of Antiquaries, which will resume the examination of the remains about the end of this month.

The fluctuations of money values convey an inadequate idea of the foreign trade of France, as evidenced by the official returns for the first six months of the year, but they clearly show a general contraction, although there was still an excess of exports over imports. The total value of imports during the six months was estimated at 10,407 million francs, representing a decline of no less than 15,784 million francs as compared with the first half of 1920. More than one-half of this declension was attributed to raw material. The falling off in the imports of manufactured goods amounted to 3885 million francs. The estimated value of exports was 10,799 million francs, or 1456 million francs less than in the corresponding six months of 1920. The decline in the exports of manufactured goods amounted to 1136 million francs. This rapid drop in the exports offers further evidence of the stagnation in the engineering industries, which, following upon the considerable development of foreign trade in 1920, had been looking with confidence to an increasing expansion of trade with foreign markets.

Miscellanea.

Operations are about to be started in boring for oil at Vancouver.

The Kiangnan Dockyard, Shanghai, proposes to construct another dockyard on the grounds in front of the Naval Wireless Telegraph Station.

As a result of scientific investigations made in the State of Tabasco, Mexico, it has been proved, according to the *Mexican Review*, that immense oil deposits are in existence in that region, practically all of the territory of the State being underlaid with oil.

The Committee of National Roads, China, has decided to construct roads between Tientsin and Peking. The Peking–Tung Hsien roads will be constructed by the American Red Cross. The new national road from Tientsin to Tung Hsien is 61 miles long. The construction will require the service of 10,000 labourers. The plan at present is to use the famine relief fund for the construction of the road, the work being done by refugees.

Two appointments have just been made by the trustees of the Beit Fellowships for Scientific Research for work to be carried out at the Imperial College of Science. The recipients of these Fellowships are Mr. H. L. Riley, who was educated at the Keighley Trade and Grammar School, and has been a student at the Imperial College for the past two years, and Mr. W. A. P. Challenor, who has been a student at the Birmingham University since the year 1917.

The metallurgical plant of the Springs and Brakpan gold mines, South Africa, is to be extended so as to deal with an extra 10,000 tons of ore per month by the addition of new tube mills. No more gravity stamps are to be put down, and the ore will go direct to the tube mills. It is anticipated that the arrangement will effect a saving of 30 per cent. on capital costs as compared with the old system of doing the preliminary crushing in stamp batteries.

Experiments in colouring colourless gem stones by exposure to radium emanation are being carried on at the Rare and Precious Metals Station of the United States Bureau of Mines at Reno, Nevada. A colourless Colorado topaz was tinted yellow, but the colouring was not permanent when exposed to light. If it is found that radium possesses the power to colour gem stones, the discovery will increase the commercial value of gem stone material found largely in the West.

At the recent annual meeting of the British Engineering Standards Association, a number of suggestions were made by those present, the more important of which were the advisability of giving greater publicity to the work of the Association, and the question of assisting purchasers to ascertain without difficulty the names and addresses of manufacturers who are prepared to work to British standards. These suggestions will be considered by a Publicity Committee recently nominated.

The plant of Wood Chemicals, South Africa, Limited, at Seven Oaks, Natal, is now nearing completion, according to the *Chemical Trades' Journal*. This company will take all the wattle timber that is produced within an economic radius and extract Stockholm tar, wood naphtha and charcoal. Later, if the enterprise is successful, acetic acid, acetone and chloroform will also be manufactured. The capacity of the plant that is being installed will be about 25 tons of wood per diem. This will yield 5 tons of charcoal, in addition to about a ton of tar and an uncertain quantity of wood naphtha.

The Department of Overseas Trade reports the discovery of a new coalfield in the Leiria district on the East Railway, at Porto de Moz and Batalha, Portugal. There are reported to be a number of seams varying from 20in. to 5ft. in thickness, with an average of 3ft. 6in. The average analysis of the coal is not known, but one exceptional result is given as follows:—Volatile matter, 26.70 per cent.; fixed carbon, 70.40 per cent.; ash, 2.90 per cent.; sulphur, 0.31 per cent.; calorific value per kilogramme (2.2 lb.), 8159 calories. A few companies are working the field on a small scale, and supplying the railway; but none appears to have sufficient capital to handle the mines efficiently, and they are all open, it is understood, to sell outright or exchange a large holding for the necessary working capital.

The blast-furnace of the Newcastle Iron and Steel Company, in Northern Natal, which has now been completed, is 70ft. by 14ft., with seven tuyeres, and provision for another if required. All tuyeres and coolers are made of copper; additional cooling plates in the hearth walls are of cast iron. Four Cowper stoves will be used, 70ft. by 20ft., the checkers being made of the company's own fire-clay. Two Stirling boilers at 180 lb. pressure, and three Bettington at 150 lb. are being provided for the pumps and generators and for blowing power. Two Allis-Chalmers blowing engines, formerly compressors, are being fitted with 5ft. air cylinders and a capacity of 15,000ft. at 10 lb. pressure. Twelve bunkers for ore and fuel are being erected, with bottom chutes and railway track on top. Five coke ovens are being erected, non-regenerative and without by-product recovery plant.

The Brush Electrical Engineering Company, Limited, asks us to say with regard to the fire which occurred at its works on the night of Saturday, July 30th, that the real facts are as follows:—One of the firm's timber sheds, containing a valuable stock of seasoning timber for rolling stock manufactures, caught fire, it is thought, by a spark from a passing train. In a few minutes the whole shed was ablaze, and it was completely destroyed, together with some log converting machines. The company's works' brigade, and also the town's brigade, with the assistance of the staff and workmen, were very quickly on the spot, and succeeded in limiting the effects of the fire to the shed in question, although at one time there seemed great danger of it spreading to the manufacturing sections of the works. As a fact, however, manufacturing operations are not curtailed in the least, nor will any unemployment be caused. A large stock of cars, omnibuses, and similar work in progress of manufacture are unharmed, and the engineering section of the works, which is further away from the scene of the fire, is also intact.

MIDLAND RAILWAY—NEW DINING CARS

MR. R. W. REID, DERBY, ENGINEER

(*For description see page* 144)

FIRST-CLASS CAR

THIRD-CLASS CAR

INTERIOR OF FIRST-CLASS DINING SALOON

INTERIOR OF THIRD-CLASS DINING SALOON

AGENTS ABROAD FOR THE SALE OF

The Engineer.

BUENOS AIRES.—Mitchell's Book Store, 576, Cangallo.
CHINA.—Kelly and Walsh, Limited, Shanghai and Hong Kong.
EGYPT.—Cairo Express Agency, near Shepheard's Hotel, Cairo.
FRANCE.—Boyveau and Chevillet, Rue de la Banque, Paris. Chapelot and Cie., 136, Bld. St. Germain, Paris.
BELGIUM.—W. H. Smith and Son, 78/80, Rue du Marché-aux-Herbes, Bruxelles, and 44, Rue Joseph II., Ostend.
INDIA.—A. I. Combridge and Co., Bombay; Thacker and Co., Limited, Bombay; Thacker, Spink and Co., Calcutta.
ITALY.—Maglioni and Strini, 307, Corso, Rome; Fratelli Treves Corso Umbarto I, 174, Rome; Fratelli Bocca, Rome; Ulrico Hoepli, Milan.
JAPAN.—Maruzen Co., Tokyo and Yokohama.
AFRICA.—Wm. Dawson and Sons, Limited, 7, Sea-street (Box 49), Capetown.
C. Juta and Co., Johannesburg, East London, and Grahamstown.
AUSTRALIA.—Gordon and Gotch, Limited, Melbourne, Sydney, Brisbane, and Perth, &c.
Melville and Mullen, Melbourne.
Atkinson and Co., Gresham-street, Adelaide.
CANADA.—Dawson, Wm., and Sons, Limited, 87, Queen-street, East, Toronto.
Gordon and Gotch, Limited, 132, Bay-street, Toronto.
Montreal News Co., 386-388, St. James-street, Montreal.
Toronto News Co., 42, Yonge-street, Toronto.
CEYLON.—Wijayartna and Co., Colombo.
JAMAICA.—Educational Supply Co., Kingston.
NEW ZEALAND.—Gordon and Gotch, Limited, Wellington and Christchurch; Upton and Co., Auckland; J. Wilson Craig and Co., Napier.
STRAITS SETTLEMENTS.—Kelly and Walsh, Limited, Singapore.
UNITED STATES OF AMERICA.—International News Co., 83 and 85, Duane-street, New York; Subscription News Co., Chicago.

Agents Abroad for Advertisements.

UNITED STATES OF AMERICA.—British and Colonial Press, Inc., 736, The Knickerbocker Building, 152, West 42nd-street, New York City.
FRANCE.—Agence Vox, 7, Rue de Surene, Paris (VIIIe).
BELGIUM.—W. H. Smith and Son, 78/80, Rue du Marché-aux-Herbes, Bruxelles, and 44, Rue Joseph II., Ostend.

SOUTH AMERICAN BRANCH OFFICE OF

The Engineer.

526, Bolsa de Comercio, Buenos Aires.

SUBSCRIPTIONS.

The Engineer can be had, by order, from any newsagent in town or country, at the various railway stations; or it can, if preferred, be supplied direct from this office.

Half-yearly (including index number) .. £1 12s. 6d.
Yearly (including two index numbers) .. £3 5s. 0d.

If credit occur, an extra charge of two shillings and sixpence per annum will be made.

Foreign Subscriptions will be received at the rates given below. Foreign subscribers paying in advance at these rates will receive The Engineer weekly and post free. Subscriptions sent by Post Office Order must be made payable to The Engineer and accompanied by letter of advice to the Publisher.

Thin Paper Copies.		Thick Paper Copies	
Half-yearly ..	£1 11s. 6d.	Half-yearly ..	£1 13s. 9d.
Yearly	£3 3s. 0d.	Yearly	£3 7s. 6d.

(The difference to cover extra postage).

Canadian Subscriptions—
Thin paper edition .. .. £2 18s. 6d. per annum.
Thick paper edition .. £3 3s. 0d. ,,

ADVERTISEMENTS.

*** The charge for Situations Open and Wanted Advertisements of four lines and under is four shillings, and one shilling per line for each additional line up to one inch. When an advertisement measures an inch or more the charge is twelve shillings per inch. The rates for all other classes of advertisements, other than those mentioned above, are included in "The Engineer Directory," which is sent post free on application. All single advertisements from the country must be accompanied by a remittance in payment. Alternate advertisements will be inserted with all practical regularity, but regularity cannot be guaranteed in any such case. All except weekly advertisements are taken subject to this condition.

Small Advertisements cannot be inserted unless delivered before TWO o'clock on Thursday afternoon (the day before publication) ALTERATIONS to STANDING ADVERTISEMENTS must arrive not later than THURSDAY of the week preceding publication.

Letters relating to Advertisements and the Publishing Department of the Paper are to be addressed to the Manager, all other letters to be addressed to the Editor of The Engineer.

Postal Address, 33, Norfolk-street, Strand, W.C. 2.
Teleg. Address, "Engineer Newspaper, Estrand, London."
Telephone Nos. 2256, 2257 Central.

PUBLISHER'S NOTICES.

*** If any Subscriber abroad should receive The Engineer in an imperfect or mutilated condition, he will oblige by giving prompt information of the fact to the Publisher, with the name of the Agent through whom the paper is obtained. Such inconvenience, if suffered, can be remedied by obtaining the paper direct from this office.*

TO CORRESPONDENTS.

*** All letters intended for insertion in The Engineer or containing questions should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

*** We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.*

By arrangement with Reuter's Engineering Service, **The Engineer** *contains the latest news from all parts of the world which is likely to be of interest to engineers.*

Contents.

The Engineer, August 5th, 1921. PAGE

July 135
Modern Marine Oil Engines.—No. V. (Illustrated.) 136
Spectroscopic Examination of Converter Flame 137
Vegetable Oils for Internal Combustion Engines 138
The Ajax-Wyatt Electric Furnace. (Illustrated.) 139
Small Steel Castings 140
A Seven-day Journal 141
Developments in Power Station Design.—No. III. (Illus.) .. 142
Midland Railway New Dining Cars. (Illustrated.) 144
Letters to the Editor—
Brick Chimney with Concrete Cornice 144
British Association, Edinburgh Meeting 144
Railway Matters 145
Notes and Memoranda 145
Miscellanea 145
Leading Articles—
The London Electricity Supply Problem 147
A Comparison of Tramways 148
The Steel and Engineering Situation 148
Books of Reference 148
The Hydraucone Regainer. (Illustrated.) 149
The "Atritor" Coal Drying and Pulverising Machine. (Illustrated.) 150
Machine for Testing the Shock Strength of Hardened Steel. (Illustrated.) 150
Some Large American Boilers. (Illustrated.) 151
The Institute of Metals 151
Hydro-electric Enterprises in Formosa 152
Building in Bombay 152
Provincial Letters—
Midlands and Staffordshire 153
Lancashire 153
Sheffield 153
North of England 154
Wales and Adjoining Counties 155
Scotland 155
Latest News from the Provinces 155
Current Prices for Metals and Fuels 156
French Engineering Notes 157
British Patent Specifications. (Illustrated.) 157
Forthcoming Engagements 158
Personal and Business Announcements 158
Catalogues 158
Paragraphs—
Standardising Fire Hose Couplings and Ball Bearings 155
Thompson Boilers 155
Institution of Electrical Engineers 155
The British Industries Fair 158

THE ENGINEER.

AUGUST 5, 1921.

The London Electricity Supply Problem.

The inquiry which the Electricity Commissioners have been holding into the question of the electricity supply of London came to an end on July 29th, after lasting twenty-six days, the last three of which were taken up by counsel speeches. Generally speaking, the latter did not do much to clear up the position as it had been revealed during the hearing of evidence. Since the inquiry first opened, of course, a great deal has been learned, and it can at any rate be said that the problem has been set out in its true perspective. The fact that the Government has decided not to proceed further with the Electricity Supply (No. 2) Bill this session has not lessened the difficulties of the Commissioners in attempting to make an order and to draft a scheme, because, as things stand, nothing, or practically nothing, can be done, except by agreement among the many parties concerned. It is true that the Commissioners have been given to understand that the Ministry of Transport will re-introduce the Bill next session and endeavour to get it passed then; but the opposition is so great on certain vital matters that the parties will have to come much closer together if the measure is to have an easy passage through Parliament. Meantime, when speaking of Joint Electricity Authorities, it has to be borne in mind that in the absence of the No. 2 Bill, these latter will have no financial powers of any kind, although perhaps that difficulty might be got over in a more or less roundabout manner, which, nevertheless, could not be regarded as a true or statesmanlike solution of this very complex problem. Finance, however, is only one of the many difficulties to be got over. Even more important and fundamental are those problems as between the local authorities, apart from the London County Council, and the companies on the question of the proposed sale of the generating stations of the latter at once, without waiting for the time to come when they can be purchased as a statutory right by the Council, *i.e.*, in 1931. In this matter, the old antagonism between companies and local authorities has appeared in almost its worst form, and credit must be given to the Council for endeavouring to break away from the old traditions and to agree upon a compromise which would enable a settlement to be come to at once, without—and this seems to be almost the only other alternative—making it necessary to continue on the present basis for another ten years. That, in a way, is almost unthinkable.

Strong endeavours have been made by the Commissioners throughout the inquiry to bring the parties nearer and nearer together by agreement, and in some respects they have succeeded, but there are even now serious stumbling blocks which will need a great deal of tact to remove. To take only one point. Whilst the local authorities, apart from the London County Council, desire to impose upon the companies—the whole undertakings of which are purchasable in 1931—the worst possible terms, if the latter hand over their generating stations at once, they are at the same time unwilling, in some cases, to hand over their own generating stations to a Joint Authority. Curiously enough, however, the London County Council, which is the purchasing authority, and the companies, would appear to be nearer agreement than they have yet been, and negotiations are now proceeding with the hope of arriving at a basis of thorough understanding. Judging from what has taken place, it almost seems that if these two sides, the buyer and the sellers, were left alone they would agree, but local legislation in London is such that the other local authorities, though they are not directly concerned with the purchase of the companies, have a right to be heard, inasmuch as they claim the terms of purchase may affect the price of electricity in their districts adversely if a Joint Authority were to be formed. Moreover, there is the legal point as to whether the London County Council has the power to transfer its right of purchase to another body without the consent of Parliament, and thus we are faced with the possibility of further delay to obtain such legislation, if it be the fact that it is necessary. One development during the closing stages of the inquiry which may not be without important consequences was the decision of the County of London Company, which has been in opposition from the beginning, to co-operate with the nine companies in promoting a scheme. Yet another factor in the situation is the admitted fear of the counties surrounding London that the London County Council is aiming at territorial expansion, and that once an Electricity Authority is formed with a large London County Council representation, then that would be used as a lever for going to Parliament to extend the London county boundary. The question of area, too, is not an easy one. The Commissioners delimited an area approximating to the Metropolitan Police area—actually a little larger—on the basis that it was an economical area for the purposes of transmission. In this they took into account the electrification of the railways and the serving of the remote districts by that means. Since the area was delimited, however, the railway companies have changed their position apparently twice. At first they gave the engineers to the London County Council distinctly to understand that they did not wish to have anything to do with a Joint Electricity Authority, and the estimates of the Council were prepared very largely on that basis. When, however, they came before the Commissioners, the railway companies stated definitely they proposed to buy in the cheapest market. That later change of front, of course, assists the Commissioners in encouraging them to adhere to their original area or something very like it on technical grounds. Meantime, two out of the four remaining schemes—the railway companies not now being in the field with a comprehensive scheme—ask for a very much smaller area.

The position is complicated in one sense, although assisted in another, by the change in the value of money and the cost of plant since most of the estimates were prepared some months ago. As the reason given for postponing the erection of capital stations was the high cost of plant and money, recent changes in that respect may possibly hasten the date when capital stations can be erected, if that be thought wise. The promoters are faced with a difficulty here because it rather seemed that the Commissioners were impressed with the willingness of the County of London Company to take the financial risk of putting up a large capital station at Barking at once, whereas the promoters of the schemes were not. As has been said more than once, however, the technical and engineering side will present few difficulties that cannot be overcome when consideration is given to them in the light of prevailing conditions. Undoubtedly the greatest trouble will be experienced in other directions, the most important of which are the assimilation of the interests of the companies and local authorities and of the interests of the counties around London with those of the county of London itself; perhaps it might more truly be said the removal of the jealousies and fears of the former as regards the latter. Over-riding all this are the limited powers of the Commissioners to compel anyone to do anything in the present state of legislation, and it is against any form of compulsion that opposition to the No. 2 Bill is partly directed. The greatest hope lies in bringing the parties together on an agreed basis, but the whole course of past legislation has created a position which makes such a possibility difficult of achievement. In London there is now a greater measure of co-operation than there has ever been before, and it is that which gives

the opponents of compulsion their strongest case. They say that if such powers as there now are for mutual working between undertakings were applied to their fullest possible extent, then all that a Joint Electricity Authority could hope to achieve would be accomplished at very much less expense and without the possibility of the irritation which supervision by such a body must inevitably bring about. These are some of the many difficulties and points of view which the Commissioners have to bring into line if they can, and we wish them well in their task.

A Comparison of Tramways.

So far as the London ratepayer is concerned, there is but little satisfaction to be obtained from a comparison between the working, during the last fiscal year, of the London County Council tramways and of those owned by the Corporation of Glasgow. London has to meet a deficit of £590,580, which would have been £806,219, had not permission been obtained to charge a part of the cost of renewals to capital account. On the other hand, we find from the recently published official accounts for the year from June 1st, 1920, to May 31st, 1921, that the Glasgow tramways not only paid their way, but that they very nearly succeeded in wiping out a large deficit of over £100,000 which had been experienced the year before. They also managed to pay £215,670 into the Depreciation and Permanent Way Renewals Fund, which stood at the end of the year at over £470,800. In contrast with that happy state of affairs, the London County Council Renewals Fund was exhausted by March 31st, 1920, and the net income received during the year under consideration was not even sufficient to pay half the cost of the renewals incurred during the year. Then, again, the Glasgow undertaking has, since it began to work in 1895, contributed very nearly £1,000,000 to that excellent institution the Common Good Fund. The London trams, it is true, in various years during the early part of their career paid certain sums in relief of the rates, but they never ought to have done so, for at the time nothing whatever was being set aside for renewals, and the ratepayers are now suffering in consequence. Nor is the tale of Glasgow's thrift yet fully told, for in addition to the Depreciation and Renewals Fund of £470,800 odd, there is a General Reserve Fund totalling £23,727; a Third Party Accident Fund of £16,663; an Employers' Liability Fund of £3805 and a Fidelity Fund of £1125. In other words, the tramways of the northern city are in a thoroughly sound financial position, while those of the London County Council are not.

Glasgow has every reason to look forward with equanimity to the result of the working of its tramways during the current twelve months, though, as will be the case in all commercial undertakings, the coal strike is certain to set its mark on it. In London, on the other hand, the outlook is of the gloomiest. The County Council's Highways Committee in its estimate of what will happen looks for a total income of £5,496,130. The total working expenses will, it is anticipated, amount to £4,847,230, including a proportion of the cost of renewals. The estimated surplus on working is therefore £648,900. It is anticipated, however, that after deducting debt and other necessary charges the actual net deficiency will be £7417, and the undertaking will have, in addition, at some time or other to repay the proportions of the cost of renewals for the past and current years, which are, temporarily, being charged to capital account. The London ratepayers will, as a fact, be fortunate if they have only to meet the deficiencies indicated above, for the estimates of the Highways Committee have nearly always in the past been too optimistic. There will be, moreover, the effect of the coal strike to reckon with, just as in the case of Glasgow, for it must have been impossible in framing the estimate adequately to foretell what it will be. In any case, even supposing that only a deficiency of £7400 odd is experienced, the financial state of the London County Council is, to use no stronger term, lamentable. As concerns renewals alone, there is absolutely nothing whatever to fall back upon. The Renewals Fund—which was for many years neglected entirely, and even when started was inadequately supported, as we have many times insisted and as events have more than proved—has, as we have said, ceased to exist. Further than that, half of what was actually spent last year, in addition to half that which will be spent during the coming year, will, as has been pointed out, be held in suspense. Much of the track is in a worn and bad condition, and it appears doubtful whether even the comparatively large sum which has been earmarked as being the cost of the renewals which are to be effected during the present year will be sufficient to pay for all that should be done.

It will, of course, be remarked that the cases of London and Glasgow are not comparable. Strictly speaking, they are not, for, for one thing, the Glasgow tramways meet with no such competition as do those in the London County Council's area. If, however, that competition had a very adverse affect, we should expect to find a considerable difference in the takings per car mile in the two cities. Yet what is actually the case? In London the receipts per car mile were, in the year 1919–20, 19.4d. In Glasgow they were 15.57d. The figures for the year 1920–21 were 20.47d. and 21.31d. respectively, Glasgow having in the meanwhile increased its charges. It cannot be said that these figures show a marked advantage in favour of Glasgow. London tramways, for all the competition they met with, only took during last year 0.84d. less per car mile than did those in Glasgow. The anticipated figure for this year is, for London, 22.55d. per car mile, or, say, 1½d. more per car mile than the Glasgow earnings of last year. It certainly is not, therefore, only the competition that they meet with that renders the London County Council's tramways financially unsound. One of the principal causes for that unhappy state is, of course, the enormous first cost of the lines. The conduit system, admirable as it doubtless is in that it does away with overhead conductors, is exceedingly expensive. On the London County Council's system by far the larger proportion of the lines is equipped with it. In Glasgow there is none of it. London, therefore, has all along had to meet comparatively crippling annual charges. Glasgow has, because it has not had to bear such heavy burdens, been able to wipe out its debt and do a great deal more than that, while London still groans under a heavy load. Its debt at the end of the financial year was still over £8,000,000. Further, we fear that it must be said that the Glasgow undertaking has been managed in a business-like way, whereas that of London has not.

The Steel and Engineering Situation.

It cannot be said, at the end of the first month after the conclusion of peace in the coalfields, that the industrial recovery has proceeded very far, though the explanation is not far to seek. A return to the *status quo ante* did not mean a great deal for industry, the conditions of which for the six months ending March 31st had been steadily deteriorating. By that date order books generally had become very bare, and it was that fact, of course, which enabled manufacturers to regard the prospects of a more or less prolonged coal strike with comparative equanimity. While the re-opening of the collieries, therefore, was the cause of much satisfaction, especially as it was brought about without the development of any serious labour-political trouble, it was not followed by an overwhelming demand for fuel for industrial purposes; indeed, in many instances there was direct evidence that the strike had led to further postponements and cancellations of business. Without labouring the point, it may be mentioned that during the coal stoppage of last autumn urgent appeals were made to manufacturers to secure fuel at any price, so that orders in hand might be completed and delivered, and heavy premiums were offered to that end. In the recent strike, however, such requests were extremely rare, even if they were made at all. But there is a sense in which the closing down of the mines for three months actually did good. It revealed to millions of workers the existence of a strong common cause binding together Capital and Labour, and it is the recognition of this mutual interest, assisted by the re-opening of the coalpits, that is now bringing about the gradual restoration of sound industrial conditions. The inexorable laws of economic forces are being understood, as never before, by the workers, who are acknowledging the futility of kicking against the pricks and are showing themselves more amenable to the spirit of co-operation between employer and employed. Moreover, the presence of huge armies of unemployed has done more than anything else possibly could do to convert the worker to the absolute necessity of the reasonable deflation of wages still being paid in the form of war bonuses. Thus a beginning is being made of the lowering of production costs, and that, with the gradual return of international exchange rates to more normal levels, provides the most hopeful prospect for British industry and commerce since the signing of the Armistice. In the meantime, although it is true that the recovery in July was not very pronounced, sufficient progress has been made to warrant the opinion that the corner of the long lane of trade slump has been turned, and that every day now should witness an improvement. By the close of the month iron furnaces were beginning to be put into blast again, in spite of prevailing high costs of coke, and numbers of steel-melting furnaces had been put into commission, for while the difference between the price of British and continental iron and steel is still a serious one, it is appreciably narrowing and a development of the present movement is most pronouncedly in favour of our makers. Even now the difference in price is so narrow as to be almost completely offset by the superior quality of the home article. On the other hand, the importation of cheap raw material is enabling British steel consumers successfully to compete with oversea rivals in steel products, with the result that many of the former are now fully employed. To a considerable extent this applies to machine tool makers and electrical engineers, as well as to some of the lighter steel branches. Forges and rolling mills are fairly well employed; but it will probably be the autumn before any general substantial improvement characterises the iron, steel and engineering industries, for where anything like activity prevails at the moment it is attributable more to work on old orders than to the booking of new business. Railway material and rolling stock orders have not so far come up to expectations, but in all cases the great need is a lowering of the cost of production. Orders will then come.

Books of Reference.

Nottingham. Issued by the Industrial Development Officer, Guildhall, Nottingham.—The city of Nottingham is known to the world at large as the home of the English lace-making industry. The book contains a brief historical sketch of the town, whilst Nottingham as an industrial centre is dealt with in another section. The city enjoys good transport facilities by water, rail, and road. The educational arrangements are well planned and much attention has been paid to open spaces for the recreation of the workers. The book is profusely illustrated.

Annuaire Sell des Maisons Françaises et Belges avec leurs Adresses Postales et Télégraphiques et Nos de Téléphone. Index des Professions Anglo-Français. Londres: Business Dictionaries, Limited, 166, Fleet-street, E.C. 4. No price stated.—In this, the second edition, of this work, Belgium has been included, with the consequence that the volume is nearly double the size of its predecessor. Part I. contains an alphabetical list of firms, giving their full addresses, with trade and telegraphic addresses. Part II. gives an alphabetical list which has been cross-referenced with Part I., thereby enabling the addressee to identify the sender of a telegram which has only been signed with a code name. In Part III. all the firms are classified under their respective trade classifications, and should prove of great use to buyers and sellers. To enable English-speaking countries to find the French or Belgian firms in any trade at once an English-French trade index is included.

Kelly's Directory of Merchants, Manufacturers, and Shippers of the World, 1921. London: Kelly's Directories, Limited, 186, Strand, W.C. 2. Price 64s. net.—This directory appears again in two volumes. It is larger than ever and more complete than last year's issue. This, the thirty-fifth edition, necessitated over 600,000 alterations, and from that fact alone the user will realise the efforts put forward by Messrs. Kelly to produce something really useful in the way of a business directory. A good account of each country is given, and a novelty has been introduced, by reproducing an outline map of the country concerned and including the names of the most important commercial and trading cities. Statistics are given of ports, principal towns, classified lists of importers, exporters and manufacturers, whilst a list is included of consuls and bankers. The British section contains a new feature, in that telephone numbers and telegraphic addresses are given. In addition to the changes made in foreign countries last year, many additional particulars have been collected. The towns of Alsace-Lorraine have been arranged in their proper order in the French section. Sections have been opened for Palestine, Syria, and the Kingdom of Hedjaz. The British East Africa Protectorate now appears as Kenya Colony. The directory has been thoroughly revised and, with the exception of Russia, may be taken as correct.

BOOKS RECEIVED.

Solvency or Downfall. By Lord Rothermere. London: Longmans, Green and Co., 39, Paternoster-row, E.C. 4. Price 2s. net.

The Case-hardening of Steel. By Harry Brearley. London: Longmans, Green and Co., 39, Paternoster-row, E.C. 4. Price 16s. net.

Sewers and Sewerage. By H. G. Whyatt. London: Sir Isaac Pitman and Sons, Limited, Parker-street, Kingsway, W.C. 2. Price 2s. 6d. net.

Textile Machine Drawing. By T. Woodhouse and Alexander Brand. London: Blackie and Son, Limited, 50, Old Bailey, E.C. 4. Price 2s. 6d. net.

The Location, Grading, and Drainage of Highways. By W. G. Harger. London: McGraw-Hill Book Company, 6 and 8, Bouverie-street, E.C. 4.

Metallography. Part II., The Metals and Common Alloys. By S. L. Hoyt. London: McGraw-Hill Book Company, 6 and 8, Bouverie-street, E.C. 4. Price 28s. net.

Useful Tables and Data for the Assistance of Consumers of Wire. Third edition. New and revised tables showing standard W.G. compared with B.W.G., B. and S., Paris, screw and card wire G.; equivalents in decimals, inches, millimetres, and sectional areas; breaking strains, lengths, conductivity, resistances, comparative costs of iron, steel, copper, bronze, aluminium, and wire strand and wire ropes; standard specifications of telegraph and telephone wire; useful calculation data, &c. &c. London: Compiled and published by W. F. Dennis and Co., 70, Queen Victoria-street, E.C. 4. Price 2s. 6d. net.

The Hydraucone Regainer.

In a paper read at the Spring Meeting of the American Society of Mechanical Engineers, Mr. W. M. White described an elaborate series of experiments, which he had carried out to determine the relative efficiencies of various types of draught tubes for water turbines, and which resulted in establishing the proper proportions for a special form that he has named the "Hydraucone." The name, by the way, is designed to convey the information that the appliance is intended for the conveyance of water in motion, and is of approximately conical shape.

The function of a properly designed draught tube is, of course, the return to the turbine of that part of the energy in the water represented by its velocity as it leaves the runner, which otherwise would be lost. The new method of regaining pressure from the velocity of fluids in motion, as set out by Mr. White, consists in causing the stream flow to impinge upon some definite shape, either flat, conical or concave, thus changing its direction, and then placing an envelope around the shape so formed upon the particular base used, which envelope conforms to the shape of the fluid at the entrance and gradually recedes from what would be the normal or free shape of the non-enclosed fluid impinging upon the particular base used. The effect of this gradually diverging envelope is to change the velocity head of fluids flowing at high velocity into its entrance into pressure and low velocity at its exit. The angle of divergence of the envelope from the normal or free shape of the impinging fluid is such as to bring about the same phenomena of flow condition as result in an expanding straight-axis tube, such as the discharge end of a Venturi meter.

The earlier experiments, among those referred to above, were made in a laboratory where a supply of about 14 cubic feet of water per second could be maintained, at a head of 15ft., by means of a motor-driven centrifugal pump. A 9in. high-speed Allis-Chalmers turbine runner was driven by this water supply and was fitted with a Prony brake with all the necessary measuring equipment. The diameter of the runner discharge orifice was 13⅜in. Beneath this orifice the various draught tubes were attached, and they delivered their water to a measuring weir. Subsequently some confirmatory tests were made, on a larger scale, at the Holyoke testing flume.

Trials were made with the experimental runner discharging direct into the water box, without any draught tube, and with several different curved tubes modelled on recognised lines. Finally, some variations of the hydraucone principle were tested. The curves given in Fig. 1 show the efficiencies of the turbine when fitted with some of the tubes tested, and also that of the hydraucone illustrated in Fig. 2, which is a type that has been utilised in a Maine power plant. Some trials were also made with hydraucones having conical centres, such as that shown in Fig. 3, and even with hollow bottom plates—see Fig. 4. The object of the last mentioned type was to try to reduce the radius of curvature of the conoidal chamber. The efficiency of these hydraucones ranged between 60 and 78 per cent. and appeared to be dependent upon a number of different factors, but all the best results were obtained with flat plates instead of conical centres. The author suggests, in this connection, that with a flat plate the water itself forms a conical centre, and that the friction of the water flowing over this cone of water is less than is the case when it flows over a solid cone.

Some experiments on small curved draught tubes, 4in. in diameter, which were tested without a turbine runner, gave very striking results. One of these models, shown in Fig. 5, had an efficiency of only 4.63 per cent. The reason for this low efficiency will be appreciated from the fact that the heavily shaded portion shown in Fig. 5 represents high-velocity water, while there was no flow at L, and the water flowed upstream, or back, in the tube in the region G. The flow conditions in this draught tube illustrate very strikingly the fact that when the walls recede too rapidly from the stream flow the latter breaks away from the inner wall and flows at high velocity on the opposite wall. It will be noted that the upper surface of the region H of high velocity is curved, as shown at the left in Fig. 5. This curvature is caused by the velocity of the water being greater at the centre of the jet than at the sides, and consequently the surface is depressed as indicated by reason of the greater centrifugal force of the centre portion of the water as it makes the turn.

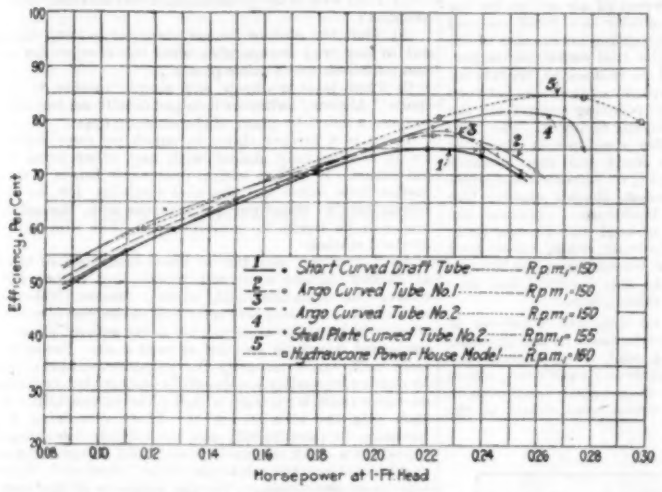

Efficiency, Per Cent
Horsepower at 1-Ft Head
1 • Short Curved Draft Tube — R.p.m.=150
2/3 • Argo Curved Tube No.1 — R.p.m.=150
• Argo Curved Tube No.2 — R.p.m.=150
4/5 • Steel Plate Curved Tube No.2 — R.p.m.=155
• Hydraucone Power House Model — R.p.m.=160

Fig. 1. Curves Showing Relation between Efficiency and Horsepower at 1 Ft. Head

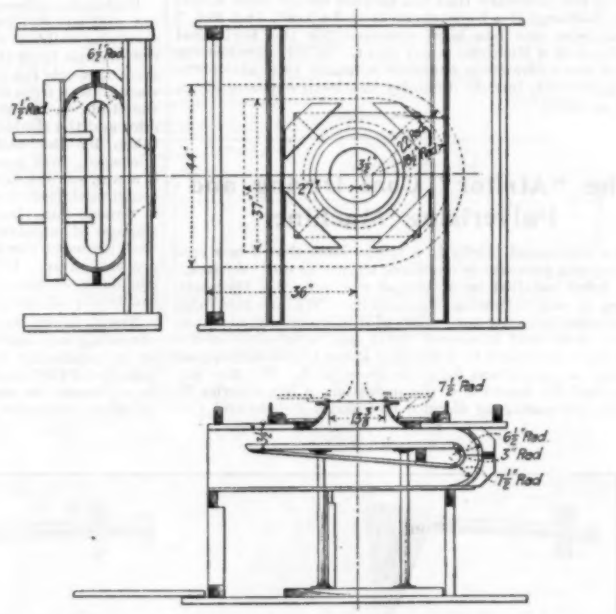


Fig. 2. Dimensions of Model of Hydraucone Regainer Used in a Number of Power Plants

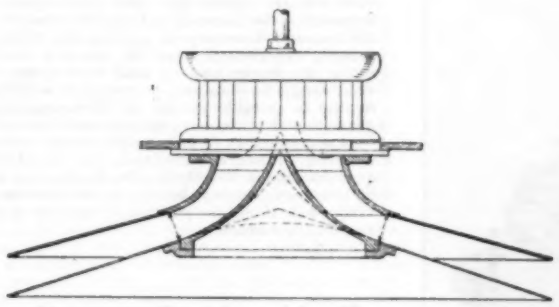


Fig. 3. Hydraucone Regainers with Cone Centers and Conical Plates

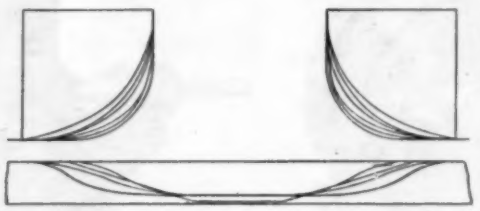


Fig. 4. Some of the Types of Regainers Tested

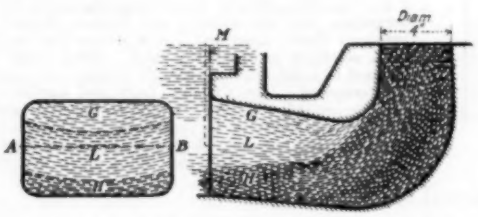


Fig. 5. Flow Conditions in Argo Draft Tube No. 1

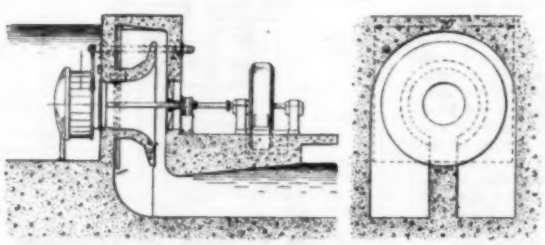


Fig. 7. Hydraucone Regainer Used with Water Wheel Having a Horizontal Shaft

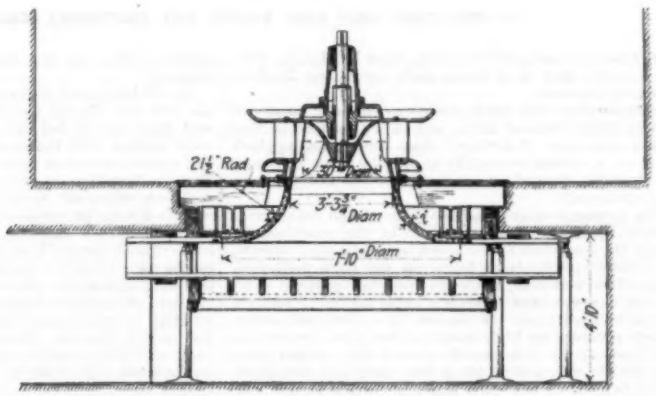


Fig. 6. Water Wheel Placed Directly on Hydraucone Regainer as in Holyoke Test

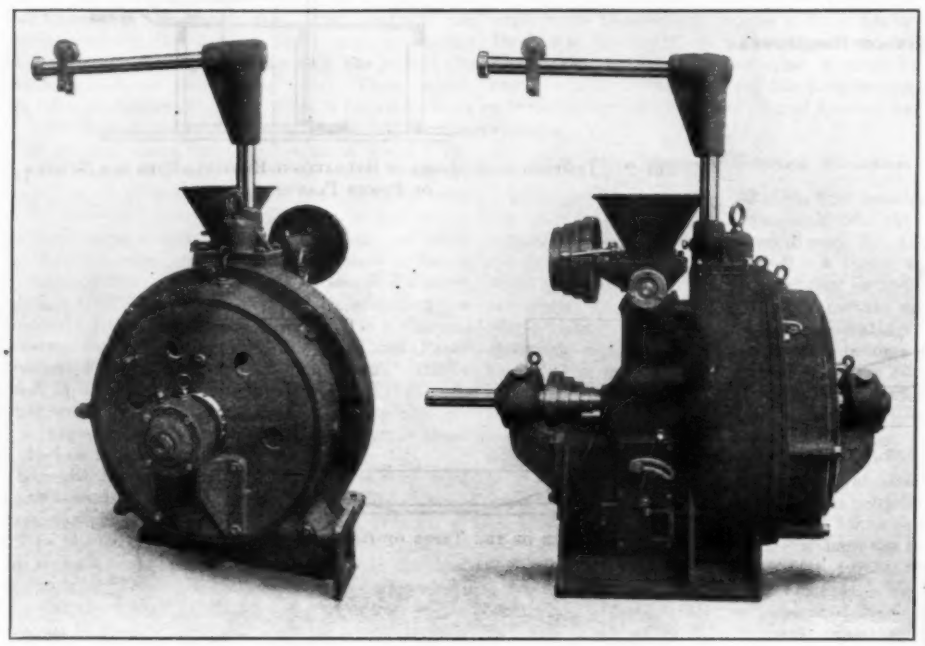
An interesting experiment was performed by placing a board M over the end of the draught tube and bringing it down to the line A B, when it was found that the efficiency of the tube was increased to 11.6 per cent. The same experiment was made by placing boards in the same relative position on the 13½in. model draught tube used with the turbine, and while some increase in efficiency was obtained, it was not in the ratio here shown.

In the Holyoke tests a 30in. turbine was used, and was set up—as shown in Fig. 6—with a hydraucone of the best proportions indicated by the laboratory experiments. The maximum efficiency of the turbine was 91.6 per cent., and was better at speeds both above and below the normal than when a long straight draught tube was used.

It is not necessary that the turbine should have a vertical discharge if a hydraucone is to be used, and Fig. 7 shows how one has been arranged for the horizontal machines in a Michigan power plant. In this instance the top of the hydraucone chamber is nearly 19ft. above the tail race level, but no difficulty has been experenced on that account.

The "Atritor" Coal Drying and Pulverising Machine.

We announced briefly in a recent issue that a new coal drying and pulverising machine, known as the "Atritor," had been installed in a cement works in the Midlands, where it was operating successfully. We are now able to give the following particulars of this interesting machine, which, if all that is claimed for it can be substantiated—and we see no reason to doubt that it can be—would appear to have an important future in front of it. We may say here that the machine is the invention of Mr. Charles E. Blyth, the managing director of Charles Nelson and Co.,



THE "ATRITOR" COAL DRYING AND PULVERISING MACHINE

cement manufacturers, of Stockton, near Rugby, in Warwickshire, and that it is being made by Alfred Herbert, Limited, of Coventry.

In this country powdered coal is principally employed for firing rotary cement kilns, and it is therefore in that direction that the "Atritor" has been first applied. It is hoped, however, eventually to employ it for numerous other purposes, though at present that has not yet been done commercially.

At the moment we are unable to describe in detail, with drawings, the internal construction of the machine, for although the invention is protected by provisional patents, the complete specifications have not yet been published. We reproduce herewith, however, two photographic views of it and can give the following explanation of its construction and working. It consists of a cast iron casing, in which revolves at high speed—some 1000 revolutions per minute, so we understand—a steel disc, which practically has the effect of dividing the casing into two parts. The disc is fixed on the shaft which is carried in the bearings seen in the illustrations. The disc has mounted on both sides of it four concentric rings of projecting studs of specially hard steel, some of which are square and some round. The studs just do not project so far from the disc as to touch the sides of the casing. Screwed into both internal faces of the casing are similar rings of studs, which are so arranged that, when the disc is in position, the rings of studs on the latter intermesh with, and revolve between, the rings of studs on the casing, without, however, touching them. Mounted on the disc at its periphery on the coal inlet side is a fan of the Sirocco type, which has the effect of drawing air into the casing.

The coal is supplied to the machine by way of the hopper at the top, which is provided with a worm feeding gear which is driven by belt from the main shaft by the cone pulleys, so that four variations of feed are possible. The raw coal, which should be in pieces of not more than 1in. cube, but may be anything smaller than that, is delivered from the hopper into an annular opening formed in the casing round the revolving shaft. As it enters, therefore, it impinges against the disc, which, as already explained, is fixed on the shaft. Through the same opening the fan, of which mention has been made above, draws its supply of air. In the case of a cement plant the air may be usefully obtained from the clinker cooler, and at the cement works in which the "Atritor" is at present fixed the temperature of the incoming air is about 550 deg. Fah. The revolution of the disc has the effect of throwing the incoming coal outwards away from the shaft, and the path of the fuel is fanwise and between the fixed rings of studs on the casing and the revolving rings of studs on the disc. Apparently, up to the time when the coal has reached the interior periphery of the casing but little, if any, fine grinding has taken place, but, on the other hand, the incoming hot air has taken up a large proportion of the moisture in the fuel.

Under the influence of the current of air set up by the fan and assisted by a second similar fan fixed on and revolving with the shaft inside the casing on the side of the disc remote from the first fan, the coal continues its progress through the machine, and as it does so, travels inwards, away from the inside periphery of the case, between the studs on the side of the disc pointing away from the inlet and the studs fixed on the casing facing it. The path taken by the coal through the machine is therefore U-shaped, first away from the shaft and then towards it again, so that, for the latter half, its direction is against centrifugal force. An arrangement, shaped exactly like a Sirocco fan, but revolving backwards, prevents the passage of unpulverised lumps of coal and throws them back between the fixed and revolving studs, where they are broken up. It is as the coal travels from the interior periphery of the casing towards this inverted fan that practically all the fine grinding takes place.

There is, we are informed, no difficulty whatever in obtaining any desired amount of fineness in the grinding or in producing dry powdered coal, even though the initial moisture content be as much as 20 per cent., which is, of course, in excess of what is ordinarily met with in practice. Samples of the pulverised coal taken at the outlet show, we are assured, practically no moisture content.

It will have been gathered from what has been said that the coal and the air travel through the machine together, and they can be led directly from the machine into the tube leading into the cement kiln. They were so led at the cement works at which we saw the machine installed. The air, therefore, in addition to being the conveyor of the fuel, acts as an aid to combustion. Furthermore, it takes with it a large proportion of the heat units extracted from the clinker into the kiln, so that they are not entirely lost. The inventor is of opinion, also, that the moisture in the air causes the formation of water gas in the kiln, the combustion of which aids the coal in burning the clinker. A further advantage of the process is that all the volatile constituents of the coal pass into the kiln and are usefully burned. Many coals contain more than 20 per cent. of volatile matter, much of which is wasted and lost in the usual type of dryer. With this apparatus the whole of it is saved.

To those who have knowledge of the existing methods of drying and grinding coal for the purpose of firing cement kilns it will be evident that if the whole process of preparing, for a kiln capable of producing, say, 1000 tons of cement per week, the necessary quantity of fuel in a sufficiently dry state and of even more than the absolutely essential fineness, can be effected in a machine, the floor space occupied by which is only 6ft. 6in. by 3ft. 8in., there will be a very considerable saving in floor space as compared with existing methods. The inventor, however, claims a good deal more than that, and we may conveniently set out his claims *seriatim*. They are :—

(*a*) That the "Atritor" takes the place of the elaborate expensive and dirty plant hitherto employed for the purpose ;

(*b*) That it is continuous in action and dispenses with the necessity for storage bins for the pulverised coal ;

(*c*) That the drying and pulverising go on together, the product being burnt immediately without being given opportunity to absorb moisture after pulverisation ;

(*d*) That all the volatile constituents of the fuel pass into the kiln and are burned ;

(*e*) That the raw coal is fed into a hopper at one end and burnt in a finely divided state like gas at the other end ;

(*f*) That it is driven by a single motor and requires no auxiliary fans, elevators, or conveyors, other than what is necessary to feed the raw coal into the hopper ;

(*g*) That when used with a rotary cement kiln the machine produces a better quality and a higher output of clinker per ton of coal than any other pulverising plant at present on the market ;

(*h*) That a rotary kiln fired by an "Atritor" is ready for use forty minutes after lighting up ;

(*i*) That the power required by it is less than half and the labour only about one-fourth that needed for the usual processes of pulverising and drying ;

(*j*) That with it the production of dirt and dust is entirely avoided ;

(*k*) That the cost of its maintenance is very small and not in any way comparable with the charges for repairs and maintenance of other plants ;

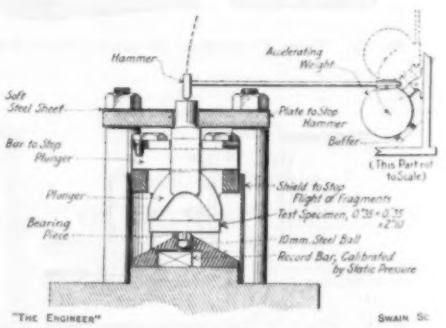
(*l*) That it is a cheap and simple matter to have a spare "Atritor," whereas it is practically an impossibility to have a stand-by plant of the existing type.

There is a further claim to which we refer separately, for it is obviously shared with any other form of coal pulveriser. It is that within reasonable limits it does not matter how much ash the coal contains, for, by adding excess lime to the slurry fed into the kiln, the ash in the coal can be made to combine with that lime and itself produce clinker.

An "Atritor" was put to work firing one of the kilns at Messrs. Nelson's cement works just before the coal strike. In common with others, Messrs. Nelson soon consumed their stock of fuel. The managing director then tried grinding the contents of some refuse heaps which contained a certain amount of coal dust. For a time all went well, but eventually the powdered refuse contained so much not readily combustible matter that it refused to do more than burn with a dull glow in the kiln. It was then that the idea struck Mr. Blyth of adding a small quantity of paraffin oil, and accordingly he arranged to introduce a small stream of that liquid along with the coal and hot air into the inlet side of the "Atritor." The effect was most astonishing. By the addition of the comparatively small proportion of 0.07 of 1 per cent. of the total weight of "fuel" of ordinary commercial paraffin the material, which had up till then refused to do more than glow dully, burnt perfectly and produced cement clinker of excellent quality. For the time being it is not quite clear exactly where the heat units came from, for, apparently, the materials fed into the kiln did not contain the quantity necessary to produce the effect which was actually experienced ; but Mr. Blyth is further investigating the matter and we shall look forward to hearing what results he obtains. At present it would appear that it may be possible by the aid of comparatively minute quantities of oil to burn substances which hitherto have been considered to be unburnable or only to be burnt with difficulty. It may be added that, with the addition of small quantities of oil, Mr. Blyth, who, by the way, has patented his discovery, claims to be able, by manipulation, to control within wide limits the position of the zone of greatest heat in a kiln or furnace.

Machine for Testing the Shock Strength of Hardened Steel.

In a paper presented before the recent annual meeting of the American Society for Testing Materials, Mr. C. E. Margerum, of, we gather, the United States Naval Ordnance Plant, described a new device for testing the shock strength of hardened steel. Many steel objects designed to resist impact were, the author said, hardened and tempered. The Charpy, Izod and similar impact tests, he argued, were not adapted to the examination of the shock strength of hardened steel. His reasons for so arguing are not very clearly expressed in the copy of his paper before us. He makes much of the fact that the



THE MARGERUM TESTING MACHINE

tests named measure a quantity of energy and not strength as measured in pounds.

The machine designed by Mr. Margerum is illustrated herewith. The specimen, in the form of a beam, is acted upon towards its ends by a forked plunger, to which blows are delivered by a hammer moving at any velocity up to 32ft. per second. The hammer is apparently simply let fall on the plunger from the angle required to give the desired velocity of striking. The specimen is supported at the mid point on its underside by a bearing piece designed to avoid "undue local deformation of the test specimen at this point." The bearing piece rests on a 10 mm. steel ball, which in turn is supported on a "record bar." The maximum load sustained by the specimen before breaking is determined from the size of the impression made by the ball on the record bar.

The record bars used by the author were cut from a large nickel-chrome forging hardened and drawn to a Brinell figure of about 270. A number of such bars were prepared from the one forging, and in them no variation of hardness

could be detected. The bars measured ¼in. by 1¼in. by 10in. long, and with three rows of impressions on each face, each bar could be used for about 200 tests. The bars were calibrated by placing a 10 mm. ball between a pair, and applying a known series of loads to them, ranging from 7500 lb. to 12,500 lb. in increments of 1000 lb. The loads used were plotted against the diameters of the impressions, and the curve so obtained was used to determine the breaking load on a specimen from the diameter of the impression produced on the record bar by the ball supporting the centre of the test piece. The breaking strength of the specimen is thus expressed in terms of pounds per square inch, and is actually the maximum pressure at the centre of the beam. Some results of experiments carried out by means of the machine were also given in the paper. The only fact of general interest that emerges from these results is that the velocity of the hammer seems to affect the recorded impact strength. The higher the velocity, the greater the recorded strength appears to be, a circumstance which is in keeping with the results obtained by other experimenters using the notched bar form of impact test.

Some Large American Boilers.

THE line drawings which we reproduce herewith, and for which we are indebted to our New York contemporary, *Power*, indicate the trend of thought, in America, in the design of new boiler-houses, and confirms the opinion expressed by several speakers at the recent Engineering Conference, that furnaces will in future be built much higher than in the past. The boilers in question belong to the completed part of the new Delaware power station of the Philadelphia Electric Company, a plant which is to have an ultimate capacity of 120,000 kilowatts. Up to the present time half the machinery has been installed; that is to say, three turbo-generators, of 22,000 kilowatts each, twelve boilers, and all the necessary auxiliaries.

The boilers, as will be seen from the drawing, are of the Stirling type, with four banks of tubes, of which the last bank forms an integral superheater. The tubes average 18ft. in length and are arranged in rows of fifty-two across the boiler. There are twenty-two tubes from back to front. The evaporative surface amounts to over 15,000 square feet, which, together with the economiser and superheater, gives a total heating surface of 20,820 square feet. The boilers are to work at a pressure of 250 lb. per square inch and will deliver steam superheated to 625 deg. Fah.

One of the most striking features about the design of these boilers is the great height of the furnaces, which was decided upon with the object of permitting the use of low-grade fuels. The furnaces have also been so designed that they can readily be altered to suit either powdered coal or oil fuel. The normal equipment is Taylor mechanical stokers, with fifteen retorts of twenty-two tuyeres for each boiler. The projected area of the grate is 312 square feet, or about one-fiftieth of the evaporating surface. From the boiler-room floor, which, as will be seen in the drawing, is at the same level as the lower part of the grate, to the centre of the steam drum, the height is 32ft., giving a ratio of furnace volume to heating surface of 0.48 to 1. It is noteworthy that the front wall of the furnace is built in two distinct sections, with the upper part supported independently on steel columns. There is a dry vertical joint between the two sections.

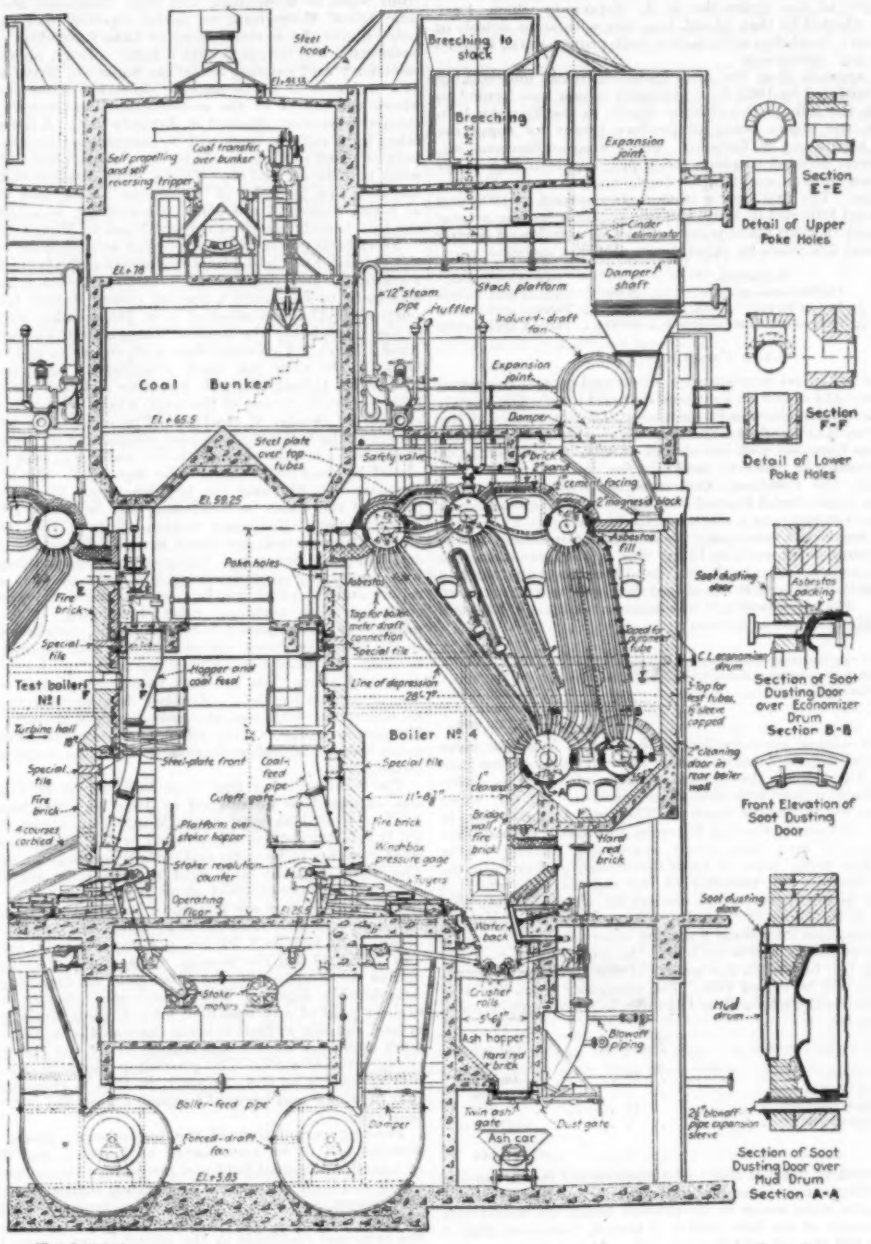
Experience with these boilers has demonstrated the advantages of the large furnaces, as the combustion is practically completed before the gases enter the tube nests and the amount of solid matter carried over by the draught into the flues is insignificant. As a matter of fact, the flue gases are so clear that the dust catchers which were installed just below the chimneys are not used. Such a state of affairs is very satisfactory in view of the powerful draught employed. Each boiler has a forced draught fan capable of delivering 80,000 cubic feet of air per minute against a head of 6in. of water, besides two induced draught fans, each of which can deal with 75,000 cubic feet at 4in. gauge. One of the latter fans is sufficient to work the boiler up to 175 per cent. of its normal rating, but for greater outputs both are required. The fan motors are of 125, 100, and 100 horse-power respectively.

The lower part of the furnaces, where the ashes and clinkers are automatically dumped, is fitted with cast iron water backs, through which the feed water is pumped, and thus raised about 10 deg. in temperature, on its way to the feed heaters. The clinkers are crushed by a pair of rolls and fall into a hopper, from which they are taken away in trucks.

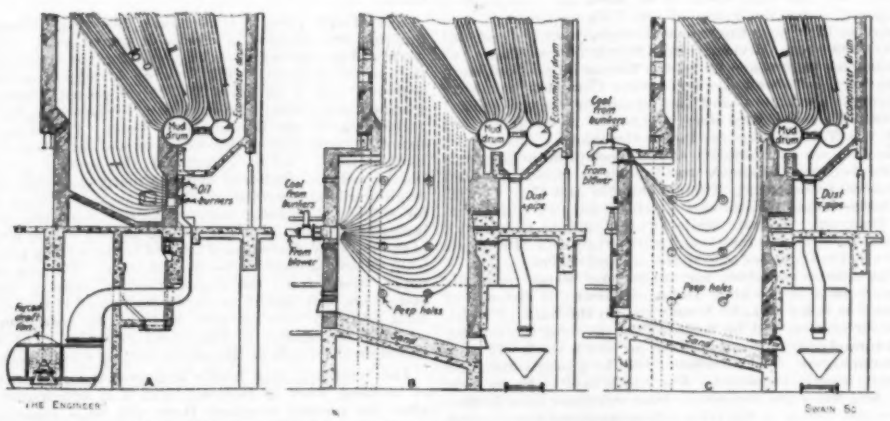
The alterations to the furnaces necessary for burning oil or powdered coal are shown in the illustrations and are made possible by the very high setting of the boilers. If it is desired to burn oil, it will only be necessary to brick over the stokers and alter the trunking of the forced draught fan. The burners can then be set in the back wall of the furnaces, as there is a clear passage under the mud drum. For burning powdered coal the stokers will have to be dismantled and the furnace bottom lowered into the basement, while the front wall will have to be built out into the firing aisle to some extent. The burners will then be installed either at about floor level or higher up, according to the class of coal to be used.

Another feature about the plant, which indicates the trend of thought among American power engineers, is the scheme for dealing with the feed water. At present it is heated up to about 210 deg. Fah. before being delivered to the economisers, in order to prevent pitting of the tubes. Provision has, however, been made for subjecting the water to a partial vacuum on its way to the boiler. It is expected that this arrangement will result in at least 95 per cent. of the air in the water being removed and permit it to be delivered to the economisers at a temperature of about 145 deg. Fah., which would result in a considerable increase in the boiler efficiency.

Elaborate arrangements have been made in the installation for safeguarding the water supplies for boiler feeding and other purposes. There is the normal feed return system from the hot well, a connection with the town main, a supply of filtered water, taken from the river, and, in cases of real emergency, raw river water can be pumped direct into the boilers. Similar precautions have been taken in the other services of the station, so that a complete shut-down is practically impossible.



SECTION THROUGH BOILERS OF NEW DELAWARE POWER STATION



ALTERNATIVE FURNACES FOR BURNING OIL AND POWDERED COAL

THE INSTITUTE OF METALS.

THE following programme has been arranged in connection with the autumn meeting of the Institute of Metals, which will be held in Birmingham from September 21st to 23rd, 1921. On the Wednesday, at 10 a.m., there will be a general meeting of members in the Examination Hall, Municipal Technical School, Suffolk-street. The Lord Mayor of Birmingham, Alderman William A. Cadbury, will open the meeting with a brief address of welcome. Papers will then be presented and discussed. At 12.40 p.m. the meeting will be adjourned to the following day. At 1 p.m. the members will be entertained at luncheon, by invitation of the Brass and Copper Tube, Brass Wire, Brassfounders Employers', Brazed Brass Tube, British Aluminium Hollowware Manufacturers', Cold Rolled Brass and Copper, and Nickel Silver Associations. Thereafter a visit will be paid to the University, where there will be a reception by the Vice-Chancellor of the University (Sir Gilbert Barling, Bart.) in the Great Hall and an address by the Principal, Mr. C. Grant Robertson. In the evening at 8 p.m. there will be a civic reception by the Lord Mayor in the City Art Gallery. On the Thursday, at 10 a.m., there will be a further general meeting of members, when additional papers will be presented and discussed as time permits. The afternoon will be devoted to visits to works. In the evening there will be a garden party at the Botanical Gardens, Edgbaston, at the invitation of the local Reception Committee. On the Friday there will be a motor excursion to Kenilworth, Warwick and Stratford-on-Avon. A list of the papers that are expected to be submitted was printed on page 97 of our issue of July 22nd last.

Hydro-Electric Enterprises in Formosa.

In a recent despatch to the Department of Overseas Trade the British consul at Tamsui, in Formosa, gave an account of the hydro-electric developments which have been effected in that island, together with some details of the Lake Candidius scheme, the main project in the island's electrical enterprises.

It appears that the first hydro-electrical undertaking was initiated in 1902 by a company which was formed to utilise the falls of the Shinten River, in the Taihoku Province, the object being to produce power for supplying light to the city of Taihoku. The Formosan Government, however, decided to place the supply of electricity under its own control, and it accordingly took over the Shinten scheme. The first power station was opened in 1905 and a second followed in 1909, the two together having a total capacity of 4000 horse-power. They were followed during the next few years by other power stations, as below :—

Year.	Situation.	H.P.	Towns supplied.
1909 ..	Chikushinmon	2000 ..	Tainan and Takao
1911 ..	Daian River	1200 ..	Taichu and Shoka
1917 ..	Rono-kei (upper course) ..	4000 ..	Tainan and Takao

Lake Candidius Scheme.

The industrial development occasioned by the European war brought about an increased demand for electric power, and a big project was formed to utilise the waters of the Dakusui River and of Lake Candidius, which is the largest lake in Formosa and lies almost exactly in the centre of the island. In order to facilitate the carrying out of this scheme, the Formosan Government decided in 1919 to float a semi-official limited liability company to take over all the Government's electrical undertakings. This company received a concession for the Lake Candidius scheme and commenced work in 1920. The date of completion is as yet somewhat vague ; the year 1924 was at first spoken of, but it is likely that the actual date will be a year or two later. The estimated cost of the undertaking is 48,000,000 yen, apportioned as follows :—

	Yen.*
Civil engineering constructional work	19,900,000
Electrical constructional work	26,500,000
Business expenses	1,600,000
	48,000,000

The scheme provides for leading water from the river Dakusui from an intake in the Shimaigahara region into Lake Candidius—the Japanese name of which is Jitsugetsutan—which will act as a reservoir for the water needed for the power station. The river Dakusui rises in the mountains of Central Formosa and makes its way first southwards and then turns westwards, passing within less than three miles of Lake Candidius, and on into the sea. The slatey character of the soil through which it passes in its upper course renders its waters muddy and gives it its name of " Muddy Water River." Candidius is a mountain lake some 6 square miles in area, lying at a height of 2400ft. above sea level. At present it is gradually drying up, but when the waters of the river are let in its surface will be raised 75ft. The waterway from the river Dakusui to the lake will be 12½ miles in length, apportioned as follows :—

Nature of waterway.	Number.	Length. Yards.
Tunnels	12	19,364
Covered cuttings	5	1,236
Open cuttings	11	842
Aqueducts	6	402
		21,844

A settling pond is also to be constructed in the hope of depositing some of the mud and sand carried by the waters, since the river water in its present condition would mar the beauty of the lake, and it is feared, moreover, that it might kill the fish which exist in it. At two points on the lake's western shore, where the banks are low, dams will be constructed of the following dimensions :—Suisha dam : height, 100ft.; length, 1800ft.; Tosha dam : height, 60ft.; length, 1000ft.

The water will leave the lake by a tunnel two miles long and will be taken down in pipes to the power station at Monpaitan, the fall being 1100ft. The volume of water at the intake on the river Dakusui will vary between a minimum of 300 cubic feet per second and a maximum of 1600 cubic feet, or an average of 954 cubic feet, which, it is calculated, should allow a steady flow at the exit from the lake of 900 cubic feet per second. At ordinary times, allowing for the 1100ft. fall mentioned above, it is expected to generate a maximum of 140,000 horse-power, or 100,000 kilowatts, with a minimum of 65,000 kilowatts.

The tunnels will be of horseshoe cross section, and those above the lake will be 19ft. high by 17ft. wide, while those leading to the power station will be 15.7ft. high and 14ft. in width. It is hoped eventually to construct a second power station some four miles below the first, the water being again carried through tunnels to the point required. A fall of 465ft. will be obtained, and it is hoped to generate a maximum of 62,000 horse-power. The two stations together would thus produce 202,000 horse-power, giving a maximum of some 145,000 kilowatts, or an average of 95,000 kilowatts. The intention is on completion of the first part of the scheme to transmit electrical energy for light and power all over the island, and the entire electrification of the Government railway system is even spoken of.

The first step requisite for the carrying out of the scheme described above has been the provision of adequate means of communication in the region covered by the works. The nearest railway station is Nisui, on the main Keelun-Taihoku-Takao line of the Formosan Government Railways, whence the Nisui-Nanto light railway line operated by the Meiji Sugar Company is available as far as the hamlet of Nama, a few miles distant. From Nama a " push car " line runs through Monpaitan, the site of the future main power station, to the town of Horisha and on to Hokusanko, where the preliminary power station is being constructed. The " push cars," it is explained, are small flat-topped trucks running on an 18in. gauge line, and they are pushed by coolies or, in the case of heavy loads, drawn by oxen.

This line would have been utterly inadequate to carry the heavy plant and materials required for the execution of the work, so it has been necessary to provide other facilities. A railway of the same gauge as the Formosan Government lines, 3ft. 6in., is accordingly being built from Nisui to Monpaitan, and from Gaishatei, about one mile below Monpaitan, an aerial ropeway will run to a point above the western shore of Lake Candidius. There, connection will be made with a light railway, operated by electricity and running as far as Suma-an, situated some two miles in a north-easterly direction from the lake, where the offices of the construction department of the company were established in January last. A network of other light railway lines will be constructed for the transport of plant and materials to the various points at which work is to be carried on. Thirty-three miles of light electric railways, 20 miles of " push-car " lines, and 10 miles of aerial ropeways are being constructed, in addition to the line already mentioned from Nisui to Monpaitan.

No electric power being at present available for running the electric lines and ropeways mentioned above and for working the rock drills for piercing the tunnels, it has been necessary to construct a special power station for those purposes. The site selected is at Hokusanko, some four or five miles below the town of Horisha, in the gorge of the Nanko River. A concrete dam with an intake on the right bank of the river has been constructed, and the water will be led through tunnels one mile in length to a point lower down the course of the river, where the power station is now in process of erection. For excavating the rock through which the tunnels pass compressed air drills have been used. On the way down the water will pass through a settling pond for the sand to be deposited. The height of the tunnel is 8ft. and the breadth about 7ft., while the depth of the water in the tunnel will be about 7ft. The fall of water at the power station will be 172ft. The side walls of the tunnels are faced with brick and the floor is constructed of concrete. The power station building itself was practically completed at the date of the consul's report and the plant was in course of erection. The latter comprises two turbines, each developing 1200 horse-power. It was expected to complete the installation early in the month of June. Great difficulty was experienced in hauling the heavy machinery up the " push-car " line described above, but the task was accomplished without loss or serious accident. Another difficulty which had to be contended with was the prevalence of malaria in the Hokusanko gorge, which, though it lies at an altitude of some 1500ft., is said to be one of the worst malaria spots in the island.

The steam railway line from Nisui as far as Gaishatei was expected to be opened in June and the remaining section, from Gaishatei on to Monpaitan, about August. On this latter section a good deal of tunnelling and other work remains to be done and completion may be delayed. The aerial wireway and light railway lines are also all expected to be completed about August next.

The constructors are fortunate in the practical absence of labour troubles. Labour is plentiful and wages average about 1.20 yen to 1.50 yen per day for male labourers and 75 to 90 sen for women. These are, of course, the figures for Formosans, the rates paid to Japanese being considerably higher. The " push-car " coolies are the highest paid of any unskilled labour, their day's wage, it is said, running as high in some cases as 4 or 5 yen. About 4000 labourers were being employed by the company in constructional work. The prevailing business depression was of benefit to the company, in that it cheapened the rate of wages and lowered to some extent the cost of raw materials.

Pending completion of the big scheme, steam power stations are to be constructed at Keelung and Shokwa to furnish additional light and power for the needs of those towns and their vicinity. The Keelung station has already been begun, and work will soon be commenced on that at Shokwa. Keelung enjoys the advantage of cheap fuel, the principal coalfields in the island being situated in its immediate vicinity.

Formosan Electric Power Company.

On a much smaller scale than the Lake Candidius project and requiring less time for completion is the installation now under construction in the Giran district of Taihoku Province, on the east coast. It was begun as a private enterprise of the Tainan Sugar Company, but the big Taiwan Electric Power Company desired to take a share. It was then decided to form an independent company under the name of the Taiwan Denki Kogyo (Formosa Electrical Enterprise) Company with a capital of 6,000,000 yen, divided into 120,000 50-yen shares, of which some were taken up by the Tainan Sugar Company, some by the Taiwan Electric Power Company, some by individual promoters, and the remainder by the general public. The company may eventually be amalgamated with the Taiwan Electric Power Company. Among the promoters are the majority of the most prominent names in the Japanese financial world, such as Mitsui, Iwasaki (Mitsubishi Company), Kaneko (Suzuki and Co.), Okura, Tankata, Asano, Watanabe Kaichi (Ishikawa Shipbuilding Company, Tokio), Wado (Fuji Spinning Company), Yamshita (the shipping magnate), Fujiyama (President of the Tokio Chamber of Commerce), and others.

The scheme provides for conducting water from the upper course of the river Dakuaui (Giran), a distance of about five miles to Lake Kyukyute, on the bank of which a power station will be built. This involves the cutting of a tunnel over half a mile long, on which work will soon be commenced. The foundations of the power station are already nearly completed. The site is said to be an ideal one, and there are, moreover, other excellent sites further down the course of the river where supplementary power stations can be erected if needed. Work was begun in June, 1920, and it is hoped to have the first power station in operation by the end of 1921 at the latest. A fall of 900 cubic feet of water per second will be obtained and the installation will have a capacity of 10,000 horse-power, or 7500 kilowatts. A large proportion of the power will be transmitted to the city of Taihoku, some 27 miles distant as the crow flies, and taken over by the Taiwan Electric Power Company. The latter company is under contract to defray the expense of erecting the transmission lines from the installation to Taihoku, and the survey of the route has already been taken in hand. The contract for the erection of the installation—other than the transmission lines mentioned above—has been let to the Okura Gumi, and work is progressing satisfactorily. Owing to the favourable nature of the locality, the cost of erection of the installation has been estimated at only 471 yen per kilowatt, as compared with 600 to 700 yen or even as high as 1000 yen per kilowatt in Japan.

The Giran district is as yet undeveloped, but it is rich in coal, timber, sulphur, and marble. A railway, which will connect the town of Giran with the Taihoku-Keelung line at Hatto, is under construction. Owing to the mountainous nature of the country the line is roundabout and construction difficult, and there is a gap of some 15 miles still to be built, on which work is proceeding apace. It is hoped to use the power produced by the present scheme for the development of the natural resources of the district. The marble will be used for the manufacture of carbide, and eventually it is intended to undertake cement manufacture and the production of timber. The promoters speak of starting work on a second power station in the year 1923 and of following that by a third. On the completion of the latter it is proposed to undertake the production of a nitrogenous fertiliser from the air, but that part of the programme is decidedly remote.

Projects also exist for the utilisation of the water of the river Daiko, in Taichu Province, and of the river Dakko, in Takao Province, while a further scheme in Taito Prefecture, on the east coast, has been projected by the Taito Sugar Company. All of these are somewhat nebulous and some have not even been fully surveyed.

* 1 yen = 2s. 0½d. at par.

Building in Bombay.

Immediately following the monsoon of 1919 a very large amount of building work was put in hand in Bombay. Very few new works had been undertaken during the course of the war, and there was an urgent demand for office and housing accommodation. Bombay during the war had increased in prosperity and population, and the result of the inadequacy of housing to meet the increased demand, due to a very considerable extent to the increased prosperity of the inhabitants and their demand for a higher standard of living, was a large rise in rents and land values.

The new building work was largely undertaken by private speculators attracted by the high rents obtainable ; and numbers of new blocks of flats and offices, in the better class districts, such as Colaba, Cumballa Hill, Napean Sea-road were erected. The constructional method generally adopted in such buildings was stone or brick construction with timber flooring. Perhaps the largest and most comprehensive scheme of office building was the development of the Ballard estate on which over forty blocks of buildings have either been constructed or are in course of construction. In general, the buildings are of stone with concrete floorings, while the foundations consist either of concrete piles or rafts. Latterly, several buildings have been put up with reinforced concrete framed structures, the speedy construction of which has been very noticeable. The first important office building of this type to be constructed was the new building for the Bombay Development Directorate, which covers over 1000 square yards, is six storeys high, and was completed in less than nine months.

The most urgent need of Bombay, however, has been accommodation for the working classes. The type of building which has been generally adopted is a concrete chawl, four or five storeys high, and containing 80 to 100 tenements. Each tenement consists of one living room with a cooking place, washing place and small verandah. Separate sanitary and washing blocks are also provided. During the past two years the first important undertaking of the kind was the provision of 1200 such tenements for the police of Bombay. The work was begun and practically completed in one year. An original scheme for housing working people has been completed, as regards the first part, by the Bombay Port Trust. On reclaimed ground near Antop Hill, about four miles distant from the business quarter of Bombay, a village was planned. Blocks of single-storied buildings, each containing about eight two-roomed tenements, were laid out. About 400 units were constructed in concrete and the remainder in brick.

The Development Directorate has vast schemes of building construction in course of preparation, but the work will not be begun on any considerable scale till after the present monsoon. The first big development scheme, however, linked up with the Development Directorate schemes, and perhaps the key work to the whole, has been undertaken by the Bombay Port Trust. This is the construction of the new cotton depôt on the Mazagaon Sewree Reclamation. When completed the cotton green at Colaba will be abolished and the many go-downs in the neighbourhood demolished, thus providing a large space for office or housing accommodation near the central business quarter. Further, it will permit of the removal of the Bombay, Baroda and Central India railway terminus from Colaba, a much-to-be-desired move. The new cotton depôt, apart from the construction of railway stations and so on, will consist in the first place of 178 go-downs, each 110ft. by 43ft. by 30ft. high. They are being constructed throughout of reinforced concrete. The depôt will store the whole of the cotton coming into Bombay.

The foregoing only briefly indicates the great activity of building work in Bombay, and it is anticipated that after the present monsoon there will be a considerably greater output of work. The most remarkable feature of the operations has been the greatly increased use of reinforced concrete, which for various reasons of economy and fireproofness is displacing older materials. Concrete firms have naturally experienced the greatest difficulty in obtaining competent foremen and staffs, but in most cases their difficulties in that direction seem to have been satisfactorily overcome.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Trade and the Bank Rate.

The reduction in the Bank rate of last week was heartily welcomed by the trading community of the Midlands, coming as it has done upon a similar relief a month ago. Cheaper money, if it can be backed by cheaper coal, will provide a stimulus to trade, but a decent position cannot be attained while unsettlement exists in the foreign exchanges. Assuming that working production is resumed after the holidays, manufacturers are hopeful that a period of stability will set in with some improvement in trade. Mills and forges in South Staffordshire and the Midlands generally have been closed during the whole of this week. Even the nut and bolt works in the Wednesbury and Darlaston district have been idle for several days. The tone throughout the iron and engineering industries is a shade more hopeful. Several steel furnaces have been started up again in the Midlands, and some blast-furnaces have been re-lit. Most of the departments at the Earl of Dudley's Round Oak Iron and Steel Works, where prior to the stoppage something like 2000 men were engaged, have either actually resumed operations or are preparing to do so. Nut and bolt makers are buying sparsely. In all departments, indeed, buyers are acting on the assumption that in the early autumn prices will recede still further. They are not convinced that prices have reached bottom. Consequently they will not close orders of any magnitude at the present moment, contenting themselves with securing just sufficient material to carry them on from day to day. On the other hand, many ironmasters have already discounted the maximum reduction in prices that they can reasonably make at present, with the result that they are now working for no profit, just to keep their organisation together.

Pig Iron Production Drags.

Iron smelters are still waiting a declaration regarding the price of fuel. A meeting of coke interests is expected to be held shortly. Until some satisfactory basis is reached the blast-furnaces in Staffordshire will remain idle. A report is current this week, however, that interests connected with smelting in Leicestershire, Lincolnshire and Warwickshire have been holding consultations with regard to the possibilities of starting up. Customers in South Staffordshire have, it is said, been invited to express their views as to the prices at which they would be prepared to buy. An offer of supplies from one large smelting concern has been made on the basis of the prices of six months ago. But most of the rolling mill proprietors do not consider this a feasible arrangement, and for the present they are inclined to stipulate day-to-day terms, especially for unexpired contracts, in which a rise and fall clause was included. Respecting forge iron, some sellers are this week understood to have accepted slightly lower prices, with the object of getting rid of surplus material. While foundry iron is wanted in fair quantities for engineering purposes, it is still subject to very keen competition from Belgium. Considerable tonnages of the latter have been offered at £6 3s. delivered into this district, a price quite impossible for any local blast-furnace. The engineering founder, as a rule, has, of course, a decided preference for local pig iron, if it can be got.

Manufactured Iron Trade.

I am sorry that I fell into an error last week concerning the price of Lancashire bars. A report was current here on the market that prices had been dropped 40s. per ton to £14, and this report I reproduced. It now turns out, however, that the statement was founded upon a merchant misconception arising out of the circumstance that the County Palatine generally leads off in any change in Crown bar prices. No reduction has occurred, and merchant bars, alike in Lancashire and in this district, still remain at £16 per ton at works. Happily, the readers of THE ENGINEER Lancashire letter last week would have seen that I was in error, so that I hope that little harm has been done; £15 17s. 6d. remains the minimum price at which Crown iron is quoted in either district, and even at this price makers declare that they are making no money. For the present the ironworks of this district are idle, except a few engaged on marked bars, and those mills which specialise on re-rolled steel. Conditions in the marked bar branch are slightly more favourable. Some orders have come in, and although they can only be described as of a hand-to-mouth character, they contain the promise of better things with the general stabilisation of trade later. Marked bars are quoted £20 at works. The galvanised sheet trade is slightly more active, and a few orders have been taken for autumn delivery. Some of the Staffordshire black sheet mills are expected to start up this month. Galvanised corrugated sheets remain at an average of £24 to £26 per ton, and black sheets, doubles, at £18 to £20. Belgian common bar iron in small lots is selling at from £10 5s. to £10 10s. delivered in this district, while other Belgian sellers quote £11, leaving a difference of fully £5 per ton between imported and Staffordshire sorts. This, of course, is a difference which cannot be maintained. Gas tube strip of district make is in small demand at £20 per ton, buyers mostly preferring to place their orders with the steel makers at about £12 10s. per ton.

Lower Steel Prices.

There is little or no improvement in the steel market, and prices continue to fall. A large steel works in South Wales, which usually sells a good deal of its steel to Birmingham, is stated to be starting shortly. The drop of £1 in bedstead angles brings the basis to £12 10s. for material delivered in this district. A slightly improved business is passing in steel sections and plates. Sales of plate shearings are recorded at £7 5s., and for indiscriminate shearings at £6. It may be recalled here that during the boom period plate shearings fetched as much as £18 10s. Welsh sheet bars have fallen by £1 per ton to £9 10s., but there is still a substantial margin in favour of continental material. Keen competition is being experienced from Belgium both in half-finished and finished steel, especially for constructional purposes. Belgian billets are quoted £7 7s. 6d., and sheet bars £8. Common plates from the Continent, reputed to be of German and Belgian make, are offered here as low as £11 to £12 per ton as against £15, which is our own figure. Reductions of 15s. to 20s. a ton in coal, coke, and 13s. to 14s. in manufacturing coal are sought to place the native steel-making industry on its feet.

Fuel.

It is notorious that slack is becoming plentiful. Colliery owners are not now able to send it out mixed with coal consignments, and they cannot find a market for it. Offers have been made in Birmingham this week of large quantities of fine slack as low as 12s. per ton, for anything above 1000-ton lots. Even lower prices are said to have been quoted. This is good news for the much-tried pig iron smelter, who believes that this slack will have to be turned into coke at very much lower prices than are now demanded. Coke is now quoted £2 5s. at the ovens. One Yorkshire coke maker has, however, quoted £1 17s. 6d. to a Staffordshire consumer. This is the most favourable offer yet received, but as 10s., at least, has to be expended in getting the fuel to South Staffordshire the offer was not accepted. Coal is slightly easier for ironworks and similar establishments, though as much as 32s. is still demanded. North Staffordshire colliery owners this week announce a reduction as from August 1st of 2s. 6d. per ton in coal prices.

New Generating Plant Required.

In view of the increased demand for electric power in Wolverhampton and district, the Wolverhampton Municipal Electric Committee is recommending an immediate extension of the generating plant at an estimated cost of £123,770.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER, Thursday.

Iron, Steel and Metals.

THE depression and stagnation in the iron and metal markets are as prominent as ever, and very few people even pretend to see their way out of the many difficulties which beset the trade. It is not alone financial trouble which is now holding up business, and those who look for relief to a further cheapening of money will probably be disappointed. No doubt the foundation of all our difficulties is in the cost of fuel, but the position has now become so involved that the cheapening of fuel, like the cheapening of money, will not of itself bring relief. We may expect fuel to be cheapened by the fact that there is not now a sufficient demand for a normal output, so that if the colliers get to work in earnest there will soon be much more fuel than can be used, and after that the work of reconstructing our trade relations and getting into markets which have been captured by other countries will occupy some time. The temporary loss of markets is always far more important than is generally understood.

Metals.

There is, naturally, more quietness in the metal markets this week because the ordinary holiday season is at its height, and this year a good many works will take advantage of the Bank Holiday to keep closed all the week. Hence there are fewer buyers about than there were, and this is saying a good deal, for it was difficult to find one last week. Copper is, of course, quite low enough, but demand is lacking, and without this one cannot expect to see any revival, however low the prices may be. The very big gap between the prices of best select and electrolytic copper perhaps reflects the unfortunate condition of the American exchange, for there is no such difference in quality or intrinsic value. The American sellers of electrolytic copper seem now to have come down to 12 cents per pound and appear to be anxious for orders at that price. Normally this would be £56 per ton, but at the present rate of exchange it is about £72. The American copper trade is still engaged in getting down the wages bill, and until this movement is at an end the output of copper will no doubt remain restricted. The real cause, however, of the poor demand for copper is not to be found in anything directly connected with the trade itself, and in all probability it is to be found in the extravagant cost of iron and steel and of engineering labour in Great Britain, and to a lesser extent in America. There seems to be very little demand now for old copper and the alloys of copper, and dealers in old metals complain very much of the state of trade and the difficulty of keeping down their stocks. As all the various kinds of old metal are relatively very cheap, these complaints certainly indicate a very bad state of trade. Tin has been a quiet market and rather easy, and one does not find that there is any marked expectation of an immediate change in the conditions. There is a large stock in the East, but it is not probable that this will be thrown recklessly on the market. There seems to be an expectation that the visible supplies of tin will increase for a time, and, of course, consumption is still very poor. The general idea seems to be that the market is fairly safe so long as it remains round about £160, for the price is thought to be low in view of present costs of production; but £160 has been broken lately and may quite possibly be broken again. There are many people in the lead market who have been expecting a fall for some time, yet this movement fails to come. The feeling, however, has been rather dull and the market a little weaker. Probably the big fall in lead which is bound to come sooner or later will be delayed until Australia can supply her full quota. Spelter has been a very quiet market, but without any appreciable change.

Foundry Iron.

The market here for foundry pig iron is very stagnant, but as there is but little iron of this class to sell now this does not matter very much. Consumers find a difficulty in getting new orders for castings, and it is clear that the foundry trade of the district is very small compared with what it was a year ago. Some of the Lancashire ironfoundries have work which they can carry on with the comparatively cheap foreign pig iron which can be obtained at about £6 per ton, but they cannot get orders which will pay them if they have to pay £9 per ton for Midland foundry iron. The quantity of foundry work which has to be done may be judged from the fact that the small supplies of this foreign pig iron are at the moment sufficient for the district. In ordinary times these supplies would not cover a tenth of the work carried on in Lancashire. There is no American foundry iron being offered here yet, and no doubt the present rate of exchange hinders the development of this business at present. No. 2 Northern American iron might conceivably take the place of Scotch No. 3 with the textile machinery makers, and as there is no Scotch worth speaking of, it might be worth while to ascertain at what lowest price this fine American pig iron could be delivered in Lancashire. The textile machinists are now the only busy section of the engineering trade of the district, and they are capable of using a large quantity of fine quality pig iron.

Finished Material.

There seems to be no serious business begun yet in finished iron and steel, and apparently consumers are waiting for what they think would be more reasonable prices, although no one is able yet to explain how prices are to be brought down in this country. The blast-furnaces have avoided the difficulty by remaining idle and without iron to sell, and it is a question whether the big steelworks will not have to adopt the same policy. At any rate, the orders now coming in are far too trifling to justify the re-starting of manufacture on a large scale. Meantime the export trade in finished iron and steel is going steadily to the foreigner and the American.

Scrap.

There is less demand now here for foundry scrap—broken cast iron—although the dealers have not yet made any reduction in the prices they ask. There is no demand at all for wrought scrap or steel scrap, and no prices are quoted, but it is understood that £3 per ton is about the selling value.

BARROW-IN-FURNESS, Thursday.

Hematites.

The first sign of renewed industrial activity is the report that next week one of the furnaces at Clestor Moor, owned by the Whitehaven Iron Company, Limited, will be put into operation. These works have been standing idle since last March. Certain orders are held for which delivery is urgently wanted. In other parts of the district nothing is being done in the way of re-starting the works, and smelters are still looking for a drop in coal and coke prices. As at present quoted there is no chance of smelters doing any business on a considerable scale. There are some consumers who point out that a cut of at least £2 will be necessary on net prices before any volume of trade can be done, and even more than that before conditions can be considered normal.

Iron Ore.

Nothing is being done at the hematite iron ore mines and the importations of foreign ore were suspended some time ago.

Steel.

What activity there has been in one department of the steel trade has been suspended for a short while on account of the holidays, but next week will see two of the mills again employed. The foundries are also idle this week. There is nothing new to report in connection with the steel trade generally, and prospects of a re-start are not bright at present.

Shipbuilding and Engineering.

An extended holiday is being observed in these trades and prospects are the reverse of good.

SHEFFIELD.

(From our own Correspondent.)

Armament Companies' Accounts.

IN spite of the long enforced holiday, the Sheffield district refused to allow the advent of August to pass without special recognition, with the result that Monday and Tuesday of this week were *dies non* so far as work was concerned, while some firms took advantage of the occasion to close down for the week. In normal times, of course, this is the period of the year when stock-taking and holidays are the conspicuous features, but it is hoped that with the arrival of September things will begin to take a definite turn for the better. The actual trade position is still very obscure, but it came rather as a shock to the district to learn that the directors of Henry Bessemer and Co. had decided to pass the interim dividends not only on the ordinary, but on the preference shares—a course, I believe, that has never before had to be taken by this fine old-established and soundly managed steel business. Another event of interest since my previous letter is a circular issued to shareholders by the directors of Vickers, Limited, explaining that the negotiations between the company and the Inland Revenue and Admiralty regarding the company's accounts for 1920 are being continued with every desire on both sides to come to as early a settlement as practicable. Good progress has been made in this

direction, but the questions involved are of such magnitude and complexity and of such importance to the shareholders that it would be unwise unduly to press them, and some time must yet elapse before a settlement can be arrived at. It may be remembered that questions were asked in the House of Commons a week or so ago regarding this delay in the presentation of Vickers' accounts. Few people can realise the complexity of the negotiations; but one thing is quite clear—Vickers is one of the British steel concerns that did most for the Allies during the war and received least, in the end, for the doing of it. More or less the same thing applies to all the armament firms, though the one specially referred to appears to have suffered more, in proportion to its larger and wider ramifications.

Basset Steel Furnaces.

A day or so ago I learnt from an excellent source some interesting facts relating to the discovery by M. Basset, of Paris, of a new direct process for the making of steel, eliminating the iron-making stage. M. Basset, it seems, estimates the production by one of his furnaces at 1000 tons of steel a week, and he has placed contracts in this country, and largely in the Sheffield district, for machinery, castings and forgings sufficient for three such furnaces and the necessary equipment. A similar quantity is said to have been placed on the Continent, chiefly with German interests, and also in the United States, so that when these are all completed M. Basset estimates that he will be able to realise an output of about 10,000 tons of good steel every week. Actual details of the plant and of the new method, I understand, have not been revealed, and, indeed, it is said that no Sheffield firm contracting to supply parts of the machinery required has been permitted to undertake a complete section. I am told that already this year something like a million and a half of French francs must have been credited to Sheffield firms on account of this work, and although the contracts, which commenced in the autumn of last year, are to be completed by October of this year, the work is hanging fire a little, it seems, as the business has been accepted at prices which make it essential that contracting firms should secure their raw material for the work at the lowest possible quotations, and markets at the moment are, of course, falling. Dick, Kerr and Co. and the English Electric Company, I hear, have the motors in hand for M. Basset's plant. The French inventor is hoping to have some of the furnaces in operation by the spring. Sheffield steel experts are following the matter with the greatest interest, though it seems difficult to obtain any definite opinion from them in consequence of the absence of anything like detail of the project, through M. Basset's reticence, but generally it is spoken of favourably, and should it prove to be the success its inventor claims for it, it is assumed that licences for the production of steel by this method will be available.

Small Proportion of Slags.

There is another new steel-making method in France, and Sheffield experts have been across the Channel inquiring into this also; but I am told that whilst at first there was an inclination to take some financial interest in the venture, it was eventually decided to leave it alone. The conclusion come to by one English expert who went into the question of M. Basset's plant was that even if it should by any means fail in its original purpose, it was of such a character as to be easily convertible into cement-making mills—which, in any case, are costly, nothing really effective being built under £100,000. To become a paying proposition, the Basset furnace, I am told, must produce at least 1000 tons of steel weekly; but by this new method that quantity should be secured from a gross output per week of 2500 tons, of which 1500 tons would be slags—a proportion which compares very favourably, of course, with the ordinary methods of steel production. Though I am not positive, I believe there is a movement being made in this district for the production of steel by a direct method, though on different lines from those of the French invention. It is some time ago now since I heard anything regarding the new steel introduced by Professor Arnold, late head of the Metallurgical Department of the Sheffield University, and taken up, I believe, by certain interests in London. The matter may be going forward still, for the proposal was to secure a works in Sheffield; but if so it is being kept remarkably quiet, for it is now long ago since I heard even a whisper. Those who assume to know anything of the steel say it has to be made in too small quantities to be of much commercial value; but one has to remember that the very name of Dr. Arnold attached to a new steel would be bound to command the greatest respect and consideration for it.

French Coal.

Another matter that is being talked about here has reference to the developments which are being made in the Kent coalfield by the chairman of the Middlesbrough iron and steel concern, Dorman, Long and Co. One generally hears the company itself associated with these pit-sinking operations in the vicinity of Dover, but I believe I am right in saying that that is hardly correct. It is Sir A. J. Dorman in his private capacity, rather than representing the well-known company of which he is the head, who is responsible for the enterprise in Kent. In fact, I am told, he was the moving spirit in the Bettes-hanger Boring Company, which carried out the prospecting work, and which afterwards sold the whole of its interests to Sir A. J. Dorman. According to one report, the area being exploited is the richest of its kind in the world, and 35ft. of excellent steam and coking coal have already been proved. I mention this because Sheffield, I believe, has some sort of financial interest in certain Kent coal areas. But, from what I understand, the coal won in that part of the country is probably most useful for shipment to France, where they have in operation stoking methods suitable for that class of fuel. During the coal strike I visited one or two boiler-houses in Sheffield where French coal was being used, and the stokers were full of bitter complaints regarding it. The difficulty evidently lay in the ignorance of the existence of a difference between British and French coal, though the latter, as well as the Kent coal, can be usefully employed for our home purposes if suitable stoking plant is provided.

Sheffield's Losses and Gains.

Although most steel firms here are realising the turn of the tide with its promise of better things to come, they still have some heavy crosses to bear. Just recently I have been hearing first-hand stories which make the position very clear. A well-known firm here tendered for railway material and afterwards learnt that the contract had gone to Belgium. Asked if rock-bottom prices had been quoted, the representative of the firm replied, "Yes; in fact, our figure would have left us with not the slightest chance of making a profit, but our works would have been kept going and our men employed. The Belgian tender that secured the contract, however, was 50 per cent. less than ours." I suggested that that was due to the difference in the rate of exchange. "No," he replied, "not altogether. One of our travellers just back from Belgium declares the workmen there are willingly putting in half as many hours again as our men are for 30 per cent. less wages." In another case I was told that the firm had been offered a million pounds sterling order for railway material by one of the Near Eastern governments, but when financial arrangements came to be discussed the would-be buyers required payment to be spread over the next twelve or fourteen years. What was the firm to do in the meantime with all the financial strain now being experienced in this country? Of course, the business had to be refused at once; but it was rather mortifying to discover that such terms had been accepted by American houses that had booked the business. If some means could be secured in this country of financing contracts of that kind what a difference it might make to our industry. But there is another aspect of the picture. The adaptability of some of the Sheffield firms is admirable. There is the Brightside Foundry and Engineering Company, for example—not one of the very large concerns, but one with any amount of enterprise and that has undergone important developments in recent years, so that its interests are now very widespread. When the trade slump caused slackness in the firm's foundries and the new brick-making machinery department was closed down through the coal strike, the directors turned their attention to the production of pit headgear, decking plants and general colliery work of that kind. They are now specialising on decking plants worked by hydraulic machinery, making it possible to bring up the shaft twelve full wagons and by automatic manipulation to release them, putting an equal number of empty wagons in their place in the cage within a very few seconds. This is a device which, obviously, will save much labour, and coalowners will have to go in for all kinds of new labour-saving devices in the future if the output is to be greatly increased.

New Pullman Car Type.

From Clayton Wagons, Limited, the associate firm of Clayton and Shuttleworth, Limited, of Lincoln, I have just received the interesting information that the company has completed for the Brighton line a new type of third-class Pullman car, different from anything of the kind previously built. The Abbey Works, I hear, have been and still are having a busy time with rolling stock construction, but by arrangement with Clayton and Shuttleworth's a good deal of the work is being carried out at the latter's Stamp End and other works—a plan which will be continued, I understand, on a large scale. Several important contracts have been received recently for oil-tank wagons, and the Stamp End works are specialising in the manufacture of tanks for these vehicles, with the result that special orders have been received from several different customers for tanks only. Clayton's are also pushing ahead with locomotive boiler work, and have received considerable orders from India and other oversea markets for locomotive boilers completely equipped.

Speeding Up at the Mines.

There has been a little friendly rivalry proceeding between the Frickley and the Hickleton Main collieries, two of the most modern-equipped mines in Yorkshire. Frickley claims to have a better one-hour winding record than Hickleton, though the claim of the latter is the world's record with 324 tons, drawn up recently in one hour. The Frickley men, however, claim to have raised in that time 388 tons from a deeper pit, the tonnage raised in one week by the Hickleton and Frickley collieries being 16,000 tons and 20,930 tons respectively. Perhaps one of the secrets is that the Frickley cages bring up twelve wagons to the surface each time as against Hickleton Main's eight, which rather reminds one of the reference in an earlier paragraph of this letter. All the miners are working better since the strike, and at Frickley, on the second day after resumption, no fewer than 2500 tons were raised. A little more of this sort of rivalry would be very welcome.

NORTH OF ENGLAND.

(From our own Correspondent.)

The Trade Outlook.

While the general trade position in the North of England cannot be said to have undergone any material improvement during the past week, there are not wanting signs that matters are gradually shaping towards a recovery in business. There are difficulties undoubtedly ahead, but the future is not entirely without hope. Much depends upon the price of fuel, which is the dominating factor so far as the iron and steel trades are concerned, and in this respect the position is becoming much easier. Wages and other costs of production are falling, and it is hoped very speedily to bridge the gap which existed between selling prices and costs of production of iron and steel. Substantial as the reductions have been in selling prices, however, British manufacturers are still being undersold by foreign rivals. The whole prosperity of the iron and steel trade is dependent upon the retention of foreign markets, and the task of recapturing our lost trade will undoubtedly be a heavy one.

Iron and Steel Exports.

The effect of the coal stoppage, coupled with the trade depression, is reflected in the iron and steel exports from the Cleveland district during July, when, for all classes of pig iron and finished material, the exports amounted to only 10,200 tons, as compared with 15,812 tons in June and an average of 35,000 tons prior to the strike. The shipments of pig iron totalled 5240 tons, of which 3205 tons went to foreign countries and 2035 tons coastwise, as against a total of 10,197 tons in June and 10,877 tons in May. The most serious collapse last month was in the manufactured iron and steel exports. India, which usually takes from 10,000 to 15,000 tons, only got 53 tons, while Japan, another good customer, took only 58 tons. The exports of finished material reached the very small total of 5615 tons, the lowest recorded for a great many years.

Cleveland Iron Trade.

Although the situation in the Cleveland iron trade shows very little alteration on the week, a more cheerful view is taken as to the outlook. This view is chiefly based upon the indications of an earlier re-adjustment of fuel prices than was at one time expected. It seems almost hopeless to expect a general resumption of pig iron manufacture in the North-East of England until coke touches a price which the ironmasters can afford to pay. At the same time it is reasonable to suggest, having regard to the economies effected in other directions, that it may be possible to resume operations as soon as a definite downward movement of fuel costs is in evidence. The glut of coke occasioned by the idleness of the furnaces, and the great slackness of the export trade, is bringing out lower forward quotations, and by the end of August it is to be hoped that the whole outlook will have changed for the better. In the meantime quotations on the Cleveland iron market may be regarded as in a transitional stage, dependent almost wholly on the existing scarcity. At the moment No. 3 G.M.B. is purchasable for immediate delivery at 135s. per ton, with an additional 5s. per ton for export. As much as 140s. per ton and 145s. respectively is, however, being demanded on forward account, though these figures are probably more or less nominal, and could be improved upon against firm offers. No. 4 foundry is scheduled at the same price as No. 3. The lower grades are still a drug on the market, notwithstanding their relative cheapness, and the prices are unchanged at 117s. 6d. for No. 4 forge and mottled, and 115s. for white. Five of the seven blast-furnaces which are now in operation are being devoted to production for the steel works, so that little is left for the open market.

Hematite Pig Iron.

There is at present no apparent sign of an opening out in the East Coast hematite pig iron trade. Makers have still a good deal of iron in stock, which for the time being will be sufficient to meet the demand developing from the home industries, and the process of getting the furnaces back into operation again is likely to be slow. At any rate not a single hematite furnace has yet been put into blast. Much will depend upon the course of business and a lowering of fuel prices. Buyers are very easy, and are disposed to proceed with great caution, with mixed numbers still at 160s. per ton. A reduction of 20s. per ton for the foreign markets appears, however, to have had but little effect on export business, the price being still above the figure at which buyers abroad would be prepared to trade.

Iron-making Materials.

There is absolutely no change in the foreign ore trade, and it is noteworthy in this connection that large quantities of continental basic pig iron are being imported into the Tees district for use at several local steel works. The coke position is uncertain and irregular, but lower quotations for furnace descriptions are probable in the very near future.

Manufactured Iron and Steel.

Steel smelting furnaces are getting away nicely, if slowly, and two or three firms have already put their rolling mills into operation. New business, however, is very sluggish, and does not encourage the hope of a very early general resumption at the works. Even the substantial cuts in prices made in recent weeks have failed to induce inquiries, and in view of increasing foreign competition the outlook for the trade is by no means a good one. Prices show no change on the week.

The Coal Trade.

The steady tone which has prevailed in the Northern coal trade for some time now is still maintained for all classes of coals where prompt or early loading is under discussion, and all collieries without exception ask and obtain full figures, but when any forward date is mentioned the position is becoming vastly different. The fact now to be reckoned with is that the forward market is not by any means assured, and there are not wanting omens which might easily occasion apprehension. The inquiries now are not for any substantial quantities as a rule, and even such as they are they result in no business except for small lots. The foreigner seems determined not to pay the present high figures, and reports to hand seem to indicate that there are ample stocks abroad, which enable foreign buyers to be independent of British supplies until they can get them at figures more in consonance with their own ideas. Everything, however, points to an opening out of the market. The ordinary law of supply and demand is now likely to operate, and this, added to the competition from other districts and coalfields, should bring about a moderately substantial revision of prices in the very near future.

SCOTLAND.

(From our own Correspondent.)

Shipbuilding.

THE shipbuilding returns for July indicate no special feature, but simply a continuance of the dullness which has characterised the industry for some time. The figures are small, but this fact may be partly accounted for by the prolonged holidays during the month. Allowing for trade depression, labour troubles, and holidays, the returns are not unfavourable. No steamer of large tonnage was included in the launches of the thirteen vessels of 29,448 tons aggregate during July. Four of these ships were over 4000 tons, and the largest was the Huntsman, geared turbine, of 8950 tons, for Messrs. Harrison, of Liverpool. The principal launch was that of a hopper dredger, 4000 tons, built by Messrs. Simons, of Renfrew, for the Commissioners of the Port of Calcutta. This is the largest vessel of its kind built on the Clyde. Work at the yards still suffers severe dislocation through the joiners' strike. A small number of vessels have been completed abroad, but many new steamers are entirely held up. The returns for this year to date cover 131 vessels of 265,248 tons aggregate, compared with 115 vessels of 352,262 tons in the same period in 1920.

Restarting Industry.

A partial re-start has been made at some of the large steel works and others are expected to follow suit. Contracts are not more plentiful, but an effort is being made to carry on as far as possible under existing conditions. Many workers have been idle since shortly after the commencement of the coal strike, and the loss in wages to steel workers in Lanarkshire is estimated at about £3,000,000. Foundry workers here and there are also receiving employment, but the outlook for blast-furnacemen is very dull. Engineers also are finding employment but in restricted numbers.

Wages Reduced in Iron Trades.

Owing to the fact that the average selling price of iron has been certified at £19 12s. 4.4d. during May and June, the ironworkers' wages are subject to a reduction of 42½ per cent. on basis rates.

Contradictory.

The fact that supplies of coal, even with a greatly reduced output, are well beyond the demand indicates that all classes of consumers are withholding their orders presumably in anticipation of cheaper prices. Prices certainly are falling, but a warning note has been struck. Merchants say that while there may be a glut of fuel at present, under anything approaching ordinary circumstances supplies would be altogether inadequate and prices would harden. Consumers therefore are advised not to restrain their buying until the time of absolute necessity. On the other hand, it is commonly said that still cheaper fuel will be procurable at the end of August.

Pig Iron.

There is no word yet regarding the relighting of pig iron furnaces. Foundry quality is becoming particularly scarce, but, generally speaking, there is sufficient on hand, supplemented by foreign material, to supply the restricted demand.

Coal.

The coal trade continues very quiet all round. Outputs are improving, but as has been already stated, the demand from all sources is very meagre. Consumers when buying, are only taking absolute necessities. Some large consumers already have their sidings full up and are therefore not in the market at present. Extremely low prices are being quoted for American coal which arrived recently, round about 30s. per ton f.o.t. Glasgow being quoted. House coal is selling in Glasgow to-day at 3s. per hundredweight, a reduction of 6d. per hundredweight since last week. Export both to Ireland and abroad is extremely slow, but a fair bunkering turnover is reported. Many collieries are now having to go very slowly, while some have had to reduce the number of shifts per week. Aggregate shipments amounted to 99,995 tons, against 88,355 in the preceding week and 214,041 tons in the same week in 1913.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Strike Aftermath.

EVENTS are taking place in the South Wales coalfields which would not have been dreamed of four months ago. At that time the miners were felt to be all-powerful. Other unions and other grades of labour in and about the mines were dominated by them. Miners' leaders openly avowed their determination to get every workman, no matter what class of work he was engaged upon at a colliery, into the ranks of the Miners' Federation. This purpose was to a very large extent achieved. Smaller and less influential unions were squeezed out of existence, for there is no organisation so despotic as the miners'. They have abused their powers for several years past, and industrial aims have been sacrificed for political ends. Their arbitrary treatment of sections of labour, which have not long been merged in the ranks of the South Wales Miners' Federation, was very pronounced during the period of the recent strike, with the result that now that the power of the miners is broken, a more independent spirit prevails. Dissatisfied members are not afraid to assert themselves, and a serious split in the ranks appears inevitable. The enginemen, stokers and craftsmen have definitely made a move to re-establish their old organisation and their separate entity, and it is not possible to say where the movement will stop. It may possibly lead to a good deal of non-unionism among miners themselves.

Craftsmen's Action.

Apparently the revolt against the Miners' Federation by the craftsmen commenced in Monmouthshire, where they have definitely broken with the miners. Then followed a meeting of representatives of enginemen, stokers, &c., at Porth, representing the Rhondda area, and now there has been a further similar gathering at Pontypridd, at which delegates from a large number of leading colliery undertakings in that district were present and were equally unanimous in their determination to revert to their old position of independence. Steps are being taken to form branches of a separate organisation, and the rules and regulations of the old Surface Craftsmen's Association are to be temporarily observed until a conference of the whole of South Wales craftsmen has been held and the rules are revised and finally determined upon. Reports show that already members are eager to rejoin their old association and are entering their names at the various lodges in good numbers. No official figures are so far forthcoming, but it is already asserted that the Miners' Federation will never again achieve the power wielded by it prior to and during the strike. The exact scope of the membership of the new association has yet to be agreed upon, but it looks very much as if the doors will be opened far wider than was the case with the old Craftsmen's Association. Subscriptions to the Miners' Federation have already ceased and money is being paid in to a new fund to revive the old organisation. The South Wales craftsmen's conference will probably be held about the 11th inst. Miners' leaders do not, of course, like this secession from their ranks, and are deploring the action. Whereas four months ago any such movement would, in all probability, have produced threatsand miners might even have been brought out on strike, the conditions now are changed.

Wage Disputes Settled.

Just when the dispute which has kept the Ebbw Vale group of collieries idle since the national coal settlement was regarded as all over, a hitch occurred with respect to colliers' trains, but since then there has been a further conference, with the consequence that points of difference have been adjusted. The agreement has been signed, and certain sections of the workmen have re-started. Apart from this dispute, other settlements have been arrived at which augur well for the future. Certainly, the spirit of pulling together is becoming more manifest. There is a greater desire for work, even though reduced wages are entailed. Following on the conference between the South Wales and Monmouthshire Steelworkers' Association and the skilled tradesmen concerned with the steel trade, the rank and file are accepting the basis of settlement arrived at. Originally, the employers offered a rate of £4 5s. to the end of September and £4 per week from then to the end of the year, but the new offer which is being accepted is a weekly rate of £4 10s. to the end of September and £4 5s. from the end of September to the end of the year. There will also be 10 per cent. off apprentices' wages up to the end of September and a further 5 per cent. from October to the end of the year. The Amalgamated Engineers' Union has also come to terms and conditions respecting a reduction in wages. The Bristol Channel Dry Dock and Engineering undertakings come within the scope of this agreement, and as from Monday last the engineers' wages will be reduced 4s. per week, and there will be a further reduction in October. The question of the 12½ per cent. reduction will come up for consideration later, should the conditions of trade warrant further investigation.

South American Trade.

The report was recently published in London that a contract has just been made on behalf of the Buenos Aires Great Southern Railway and Buenos Aires Western Railway companies for a substantial quantity of Welsh coal at 30s. per ton, plus 14s. freight. Firms at Cardiff directly interested in South American business fail to confirm the report. They have not been asked to tender, but it is possible that some business for prompt cargoes has been arranged with London firms. It is not large coal, however, which has been sold at the price of 30s., but in all probability cargoes are made up of half second Admiralty large coals at 40s. and half superior smalls at 20s., thus giving for the mixture a price of 30s. per ton. Outward rates of freight have recently fallen away, and are now down to 14s. to 15s. for River Plate, and the result is that South Wales can compete for South American business.

Instructions Concerning Wages.

South Wales colliery companies have received instructions concerning wages for August and September. With regard to August, the notice states that the wages payable will be the 1915 standard rates applicable to the different classes of workmen and boys, plus 55.83 per cent., plus the following additions:—To workmen above eighteen years of age, 20 per cent., with a minimum of 2s. per shift, plus 2s. 6d. per shift; to boys sixteen years of age and under eighteen years, 20 per cent., with a minimum of 1s. per shift, plus 2s. 6d. per shift; to boys under sixteen years of age, 20 per cent., with a minimum of 9d. per shift, plus 1s. 3d. per shift. As regards wages payable in September, notice will be issued in due course. The wages will be 6d. per shift for workmen above sixteen years of age and 3d. per shift for boys under sixteen less than the wages payable in August. The additional 14.2 per cent., as the result of the reduction in hours from eight to seven, must continue to be paid to pieceworkers. The amount of wages which the colliery owners will have to bear themselves is 29.5 per cent. upon the 1915 standard rates up to August 31st, with the addition of 14.2 per cent. in the case of pieceworkers, the difference between this amount and the wages actually paid to the workmen being recoverable from the Government. Details concerning the wages of officals are given, and it is pointed out that the amount payable by the Government towards the wages of officials will be 6s. 8½d. per shift for the month of August.

Current Business.

The official holiday in the coalfield was this year limited to Monday—Bank Holiday—but, of course, many workmen extended their leave. Still it is fully expected that outputs this week will be fairly good, although coal exports will be scarcely likely to come up to the quantity of last week, viz., 234,648 tons, which figure has only been exceeded twice this year. Business is rather quiet, for the reason that exporters had made their arrangements for loading immediately after the holiday, and, furthermore, collieries, being fairly well stemmed, preferred to see what outputs were like before accepting fresh commitments. The tone of the market is very steady.

Latest News from the Provinces.

THE MIDLANDS AND STAFFORDSHIRE.

Great Reduction in Iron Trade Wages.

THE Midland Iron Trade Wages Board has this week declared a drop of 80 per cent. in ironworkers' wages, resulting from the accountants' examination of iron trade selling prices for the two months ending June last. This is the heaviest individual reduction recorded since the war.

LANCASHIRE.

MANCHESTER.

Manchester Water Supply.

AT a meeting of the Manchester City Council on Wednesday last, sanction was granted to the expenditure of £206,000 on the construction of part of the fourth line of pipes from Thirlmere. It is proposed to make a junction at Garnett Bridge, near Kendal, to connect the Haweswater with the Thirlmere pipe. In this way an additional supply will be obtained from this lake before the Haweswater scheme is fully completed. The state of trade in Manchester is reflected by the consumption of water this year, which has only been 48¼ million gallons per day, as against 52 million gallons per day last year.

WALES AND ADJOINING COUNTIES.

Tinplate Trade.

The tin-plate mills of Messrs. Richard Thomas and Co., of Llanelly, re-commenced operations on Tuesday, after being idle since the beginning of the year.

Coals for the Argentine.

It is now reported that a contract for the Argentine railways has been made for 10,000 tons per month for four months, *i.e.*, September to December inclusive. The coal is Monmouthshire Black Vein, the price being 35s. for large and 20s. for smalls, the price therefore working out, on the basis of two-thirds large and one-third small, at 30s. per ton. The total quantity is 40,000 tons

Swansea Metal Market.

Inquiries are rather more numerous, and are expected to improve as costs of production come down and makers can compete. That costs are decreasing is shown by the fact that sheet and tin bars have been cut by another £1 per ton, making the price £9 10s. per ton. Actual business is as yet, however, quiet.

THOMPSON BOILERS.—We have been requested to state that the pulverised fuel-fired boiler described as a "Thomson" boiler in our issue of July 22nd was constructed by John Thompson, Water Tube Boilers, Ltd., of Wolverhampton.

INSTITUTION OF ELECTRICAL ENGINEERS.—The Council of the Institution of Electrical Engineers has decided that, beginning with next session, the meetings will be held on alternate Thursdays—except at times of public holiday—beginning with the first Thursday in November. The Council has at present under consideration the question whether the meetings should continue to begin at 6 p.m., as has been the case during the last few years, or whether the former hour of 8 p.m. should be reverted to.

STANDARDISING FIRE HOSE COUPLINGS AND BALL AND ROLLER BEARINGS.—The standardisation of fire hose couplings, including gauges to be employed in their manufacture, was recently discussed at the Institution of Civil Engineers by a fully representative conference called by the British Engineering Standards Association, under the chairmanship of Colonel R. E. Crompton. A request for this matter to be taken up had been received by the B.E.S.A. from the National Fire Brigades' Association, and the calling of a conference was at once sanctioned in order to ascertain whether those interested in the matter were in favour of this standardisation being carried out. The general opinion of the conference was that, however desirable it might be to establish a single type of coupling, it was not practicable at any rate for the present, but it was unanimously agreed that in the interests of manufacturers, users and the public services the standardisation of the three types of fire hose couplings in general use in the country would be of great benefit, and a resolution was adopted recommending the formation of a sectional committee of the B.E.S.A. to undertake the work. A conference was also recently called by the Association at the Institution of Civil Engineers, also under the chairmanship of Colonel R. E. Crompton, to discuss the standardisation of ball and roller bearings covering the requirements of the engineering industry as a whole, the purpose of the inquiry being to ascertain, before proceeding further, whether there exists a consensus of opinion favourable to the work being undertaken. It was quickly evident that there was no doubt in the opinion of those present as to the desirability of the proposed standardisation, the only points upon which there was any discussion being in connection with the actual types of bearings to be included. A resolution was unanimously passed recommending the setting up of a sectional committee to undertake the work, and such a committee will, no doubt, be formed as soon as circumstances permit. This sectional committee will not, we understand, supersede the existing B.E.S.A. committees dealing with ball bearings for automobile and aircraft purposes, but will co-operate with them.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
Native	49/- to 60/-
[1] Spanish	30/-
[1] N. African	30/-
N.E. Coast—	
Native	—
Foreign (c.i.f.)	37/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—[2]		
Hematite	9 0 0	—
No. 1 Foundry	8 15 0	—
No. 3 ,,	8 10 0	—
N.E. Coast—		
Hematite Mixed Nos.	8 0 0	7 0 0
No. 1	8 2 6	7 12 6
Cleveland—		
No. 1	—	—
Silicious Iron	—	—
No. 3 G.M.B.	6 15 0	7 0 0
No. 4 Foundry	6 15 0	7 0 0
No. 4 Forge	5 17 6	6 2 6
Mottled	5 17 6	6 2 6
White	5 15 0	6 0 0
Midlands.		
Staffs. *(All nominal).*—		
All-mine (Cold Blast)	17 0 0 to 17 7 6	
Part Mine Forge	8 0 0	
,, Foundry No. 3	9 0 0 to 9 5 0	
Northampton [3] *(All nominal).*—		
Foundry Nos. 2 and 1	8 10 0	
,, No. 3	8 5 0 to 8 10 0	
,, Forge	6 17 6	
Derbyshire [3] *(All nominal).*—		
No. 3 Foundry	8 5 0 to 8 10 0	
Forge	7 0 0	
Lincolnshire [3]—		
Basic	*Uncertain.*	
Foundry	,,	
Forge	,,	
N.W. Coast—[2]		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	8 0 0	
Special	9 0 0 to 11 0 0	

MANUFACTURED IRON

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	16 0 0	25 0 0
Best ,,	17 0 0	—
N.E. Coast—		
Crown Bars	16 0 0	19 0 0
Best ,,	17 0 0	20 0 0
Tees	15 10 0	15 10 0
Lancs.—		
Crown Bars	16 0 0	—
Hoops	20 5 0	20 0 0
S. Yorks.—		
Crown Bars	16 0 0	—
Best ,,	17 0 0	—
Hoops	20 5 0	—
Midlands—		
Marked Bars (Staffs.)	20 0 0	—
Crown Bars	16 0 0	—
Nut and Bolt Bars	16 0 0	—
Black Sheets (dbls. nom.)	18 0 0 to 20 0 0	
Galv. Sheets, 24 W.G. (f.o.b. L'pool, or equal	24 0 0 to 26 0 0	
Gas Tube Strip	20 0 0	—

STEEL.

	Home.[5] £ s. d.	Export.[6] £ s. d.
Scotland—[4]		
Boiler Plates	20 0 0	24 0 0
Ship Plates ⅜in. and up	15 0 0	—
Sections	14 10 0	—
Steel Sheets ⅛in. to ⅜in.	16 5 0	—
Sheets (Gal. Cor. 24 B.G.)	—	26 0 0

STEEL (*continued*)

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	15 0 0	15 0 0
Angles	14 10 0	14 10 0
Boiler Plates	21 0 0	21 0 0
Joists	14 10 0	14 10 0
Heavy Rails	14 0 0	—
Fish-plates	19 0 0	—
Channels	20 0 0	—
Hard Billets	13 0 0	—
Soft Billets	11 10 0	—
N.W. Coast—		
Barrow—		
Heavy Rails	14 0 0	—
Light ,,	17 0 0 to 19 0 0	
Billets	13 0 0	—
Ship Plates	15 0 0	—
Boiler ,,	21 0 0	—
Manchester *(Prices irregular and uncertain, unchanged)*—		
[7] Bars (Round)	14 0 0 to 16 0 0	
[7] ,, (others)	15 0 0 to 16 10 0	
Hoops (Best)	20 5 0	20 0 0
,, (Soft Steel)	17 5 0	17 0 0
Plates	15 0 0	—
,, (Lancs. Boiler)	21 0 0	—
Sheffield *(Prices irregular and uncertain)*—		
Siemens Acid Billets	18 0 0	—
Bessemer Billets	17 10 0	—
Hard Basic	13 0 0	—
Soft ,,	12 0 0	—
Hoops	17 5 0	—
Soft Wire Rods	13 5 0	—
Midlands—		
Small Rolled Bars	12 10 0 to 14 10 0	
Soft Billets and Bars	12 0 0	—
[2] Hoops	17 0 0	—
Tube Strip	12 10 0 to 13 10 0	
Angles and Joists	14 10 0	—
Tees	15 10 0	—
Bridge and Tank Plates	15 0 0	—

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	23/6 to 28/-
Block Tin (cash)	158 10 0
,, (three months)	160 10 0
Copper (cash)	70 5 0
,, (three months)	70 12 6
Spanish Lead (cash)	23 12 6
,, (three months)	23 2 6
Spelter (cash)	25 5 0
,, (three months)	26 2 6
Manchester—	
[8] Copper, Best Selected Ingots	71 10 0
,, Electrolytic	75 10 0
[9] ,, Strong Sheets	105 0 0
,, Loco Tubes	0 1 3½
Brass Loco Tubes	0 1 1½
,, Condenser	0 1 5½
Lead, English	25 0 0
,, Foreign	23 15 0

(*Metal prices practically unchanged*).

FERRO ALLOYS.

(*All prices now nominal*).

	Per Ton.	Per Unit
Tungsten Metal Powder	2/- per lb.	
Ferro Tungsten	1/8 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£35	12/-
,, 6 p.c. to 8 p.c. ,,	£37	15/-
,, 8 p.c. to 10 p.c. ,,	£36 10 0	15/-
,, Specially Refined		
Max. 2 p.c. carbon	£86	32/-
,, 1 p.c. ,,	£96	39/-
,, 0·75 p.c. carbon	£120	47/-
,, carbon free	2/9 per lb.	
Metallic Chromium	6/6 per lb.	
Ferro Manganese	(per ton) £18 for home.	
,, Silicon, 45 p.c. to 50 p.c.	£15 10 0 scale 8/6 per unit	
,, ,, 75 p.c.	£22, scale 12/- per unit	
,, Vanadium	22/- per lb.	
,, Molybdenum	10/- per lb.	
,, Titanium (carbon free)	1/6 per lb.	
Nickel (per ton)	£190	
Cobalt	15/- per lb.	
Aluminium (per ton)	£150	

FUELS.[10]

	Export.
Scotland.	
Lanarkshire—	
(f.o.b. Glasgow)—Steam	36/-
,, ,, Ell	37/6
,, ,, Splint	40/-
,, ,, Trebles	38/-
,, ,, Doubles	36/6
,, ,, Singles	34/6
Ayrshire—	
(f.o.b. Ports)—Steam	35/6
,, ,, Splint	40/-
,, ,, Trebles	32/-
Fifeshire—	
(f.o.b. Methil or Burntisland)—Steam	35/- to 40/-
Screened Navigation	45/-
Trebles	36/6
Doubles	35/6
Singles	34/-
Lothians—	
(f.o.b. Leith)—Best Steam	35/-
Secondary Steam	32/-
Trebles	35/-
Doubles	32/-
Singles	31/-
England.	
[11] N.W. Coast—	
Steams	45/- to 49/-
Household	56/8 to 60/-
Coke	58/-
Northumberland—	
Best Steams	40/- to 42/6
Second Steams	37/6 to 40/-
Steam Smalls	13/- to 17/6
Unscreened	30/- to 35/-
Household	36/- to 40/-
Durham—	
Best Gas	38/- to 39/-
Second	35/- to 37/6
Household	36/- to 40/-
Foundry Coke	55/-
Sheffield—[12]	
S. Yorks. Best Steam Hards	33/2 to 33/8
Derbyshire Hards	32/8 to 33/2
Seconds	31/8 to 32/2
Cobbles	31/8 to 32/2
Nuts	31/2 to 32/2
Washed Smalls	28/8 to 30/2
Best Hard Slacks	20/- to 25/-
Seconds ,,	20/- to 23/-
Soft Nutty ,,	20/- to 25/-
Pea ,,	18/- to 22/-
Small ,,	15/- to 18/-
House, Branch	40/2 to 40/8
,, Best Silkstone	36/8 to 37/2
Blast Furnace Coke	(45/-, 55/- export)
Cardiff— [13] South Wales.	
Steam Coals:	
Best Smokeless Large	44/- to 45/-
Second ,, ,,	42/6 to 43/6
Best Dry Large	42/6 to 45/-
Ordinary Dry Large	40/- to 42/6
Best Black Vein Large	41/- to 45/-
Western Valley ,,	42/6 to 43/6
Best Eastern Valley Large	42/6 to 43/6
Ordinary ,, ,,	40/- to 42/6
Best Steam Smalls	25/- to 27/6
Ordinary ,,	17/6 to 22/6
Washed Nuts	42/6 to 47/6
No. 3 Rhondda Large	45/- to 47/6
,, ,, Smalls	35/- to 37/6
No. 2 ,, Large	40/- to 42/6
,, ,, Through	35/- to 37/6
,, ,, Smalls	17/6 to 20/-
Coke (export)	60/- to 65/-
Patent Fuel	40/- to 45/-
Pitwood (ex ship)	37/6 to 40/-
Swansea—	
Anthracite Coals:	
Best Large	55/- to 60/-
Seconds	55/- to 57/6
Red Vein	55/- to 57/6
Big Vein	55/- to 57/6
Machine-made Cobbles	67/6 to 72/6
Nuts	70/- to 72/6
Beans	60/- to 65/-
Peas	42/6 to 47/6
Breaker Duff	15/- to 17/6
Rubbly Culm	22/6 to 25/-
Steam Coals:	
Large	42/6 to 45/-
Seconds	40/- to 42/6
Smalls	17/6 to 22/6
Cargo Through	37/6 to 40/-

[1] Delivered. [2] Not Makers' works. [3] At furnaces. [4] Glasgow, Lanarkshire and Ayrshire. [5] Home Prices—All delivered Glasgow Station.
[6] Export Prices—F.O.B. Glasgow. [7] Prices represent the real market before the *official* change was made. [8] These prices are practically alike now.
[9] Sheets reduced while other prices are advancing. [10] Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. [11] For inland sales. [12] Per ton f.o.b.

French Engineering Notes.

(From our Correspondent in Paris.)

Naval Propaganda.

In view of the success of the maritime manifestations at Havre, Rouen and Dieppe there can be no doubt that popular opinion in this country is solidly in favour of creating a more powerful navy, consolidating the merchant marine, and constructing the docks and other equipments necessary for the new fleets. Those manifestations followed upon the Congress on Inland Navigation at Rouen and on conferences by the Ligue Maritime, which carried out all arrangements. There were races of motor boats and gliders from Paris to the sea, and very high speeds were accomplished by the Farman and Lambert gliders, which appear to be forerunners of a type of craft that may be extremely useful for rapid transport on shallow colonial rivers. The President of the Republic visited Havre, where he was shown the works in progress under the vast programme of harbour extensions, for which it is hoped to raise the necessary funds by public subscription. That, indeed, was the object of the manifestations, for it is very difficult to get money from sources that are almost exhausted, and the only hope of success lies in giving a national character to the programme which will enable Havre to cope satisfactorily with the present heavy traffic. The President passed in review a squadron in which the British and American navies were represented. He then went to Rouen and saw under construction the docks that are to make the town a distributing centre for the inland waterways as well as for Paris, which, as soon as the work of deepening the Seine is completed, will regard Rouen as an advance port. Finally, the President paid a visit to Dieppe, where improvements to the fishing fleet claimed his attention, and he inspected the new steamer Versailles, which is to be put on the Newhaven-Dieppe service, and is expected to effect the crossing in less than three hours.

An Engineers' Federation.

While the various branches of the engineering trades have had their employers' associations there has long been a need of an amalgamation of their different interests, and for more than a year past efforts have been made to create a general federation, which has happily now been placed on a sound footing. The official title of the new amalgamation is the Fédération des Syndicats de la Construction Mécanique, Eléctrique et Métallurgique de France, with headquarters at 94, Rue d'Amsterdam, Paris. The president is M. A. Rateau, of the Académie des Sciences. The Fédération de la Mécanique, as it is called for convenience, represents about 3000 works employing nearly 400,000 hands. It will carry out a definite programme, which will comprise an investigation of all economical questions affecting industries employing metals, the obtaining of raw material under the best possible conditions, the organisation of the export trade on a rational basis, and the creation of a service which will be always in contact with Parliament and the various public bodies. For some time past there has been a good deal of irritation over the attitude of the Government in adopting fiscal and other measures without sufficiently consulting the engineering industries. The statement of the President of the Republic during his visit to Rouen that the fiscal policy constitutes an integral part of the foreign policy has been particularly criticised. In the opinion of the President the fiscal tariffs should be used as a means of forcing the hands of foreign countries. Engineers regard this as a fatal policy, and they hope that the new Federation will enable them to exert some influence upon the future deliberations of the Government affecting the industrial prosperity of the country.

Paris Refuse.

The collection of refuse in Paris and its incineration in the four existing destructors has undergone great improvement during the past year, but there is still much to be done, and the Prefect of the Seine has submitted a new proposal to the Municipal Council for the provision of greater facilities for collection and for discharging at the destructors. The cost of carrying out the programme is estimated at 70 million francs. The daily collection in Paris during the winter months amounts to about 4000 cubic metres, representing 2400 tons. To this must be added the refuse arriving from the adjoining communes, which brings the total up to 3000 tons. Consequently, each of the four destructor plants should be capable of dealing with 750 tons of refuse in twenty-four hours. During the summer the quantity collected is about one-half the above total. It was suggested during the discussion on the proposal that householders should be offered inducements to burn the refuse themselves, as was done during the war; but apart from the serious difficulties presented by this scheme, it was pointed out that after incineration the refuse had an appreciable value as manure. It is evident that something must be done to solve completely this problem, for considerable quantities of refuse, that cannot be dealt with by the destructors, are dumped down outside Paris, often under insanitary conditions.

The Motor Trade.

Amidst the general stagnation of trade there are signs of recovery in some industries, notably the electrical branch, and several motor car firms are beginning to experience a better demand, as the result partly of the lower price of petrol. It is reported that the Citroeh factory is turning out fifty cars a day, and another leading firm has sold out its large stock of vehicles and is now finding itself in arrears with the execution of orders. The improvement is principally noticeable by manufacturers of light and economical cars, which have evidently profited from the higher duties on imported vehicles. The absorption of the large stock of war cars has also prepared the way for an improvement in the motor trade.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

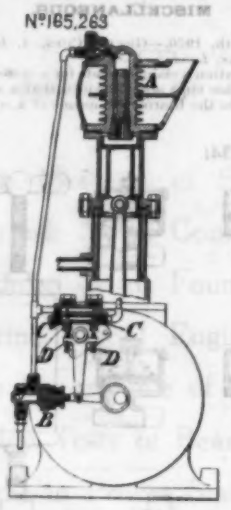
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM ENGINES.

165,263. April 15th, 1920.—Uniflow Engines, H. R. Ricardo, 21, Suffolk-street, Pall Mall, London, S.W. 1.

In this engine the necessity for steam admission valves is avoided by intermittently generating just enough steam for each stroke of the piston. The exhaust is controlled in the usual manner of the uniflow engine. Above the cylinder there is a

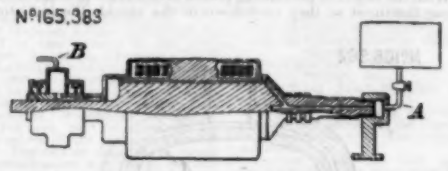


steam generator A, which is heated in any convenient manner. At the commencement of each stroke a small quantity of water is injected into the generator by the pump B. Two by-pass valves C C, the stroke of which can be varied by the tappets D D, are used to regulate the amount of water delivered by the pump to the steam generator.—*June 30th*, 1921.

DYNAMOS AND MOTORS.

165,383. April 22nd, 1920.—Cooling Rotors, H. A. Carney, Antrobus Hall, Mobberley, Cheshire, and H. M. Lacey, 221, Harrow-road, Paddington, London.

The inventors propose to cool the rotors of electric generators by evaporating water in passages provided in their mass. The



water is fed in at A and the vapour collected at B. It is suggested that the vapour should be conveyed to the condenser of the prime mover.—*June 30th*, 1921.

TELEGRAPHS AND TELEPHONES.

145,476. June 21st, 1920.—Subterranean Signalling Systems, L. de Forest, 1391, Sedgewick-avenue, New York.

In this system of telegraphing or telephoning a circuit is established at the transmitting station, shown in Fig. 1, by an overhead wire and a stratum at some considerable depth below

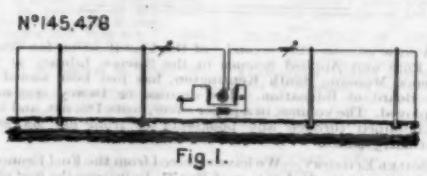


Fig. 1.

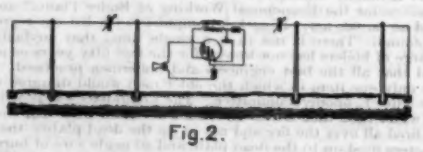
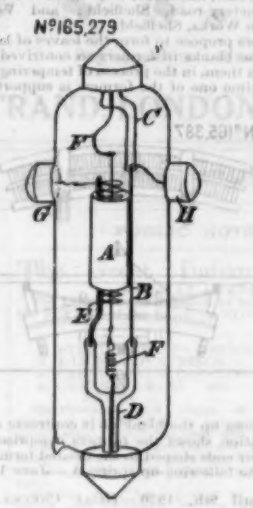


Fig. 2.

the surface of the earth, with which connection is made by means of earth plates and insulated cables. An alternating current having a frequency of from 500 to 25,000 cycles per second is generated in this circuit. At the receiving station, Fig. 2, a similar circuit is arranged and is provided with a detector and telephone receiver.—*June 30th*, 1921.

165,279. April 28th, 1920.—Vacuum Tubes, J. Scott-Taggart, East Bank, Smithhills, Bolton, F. O. Read and P. W. Engelbach, 13, Great Queen-street, London, W.C. 2.

With the object of providing a stronger structure and facilitating the adjustment of the various parts of vacuum tubes used in wireless telegraphy, the inventors support the anode A on a wire B, which is fixed in glass pillars C and D at opposite ends of the tube. The pillar D also carries the supports E for the grid electrode. The filament is hung between the springy

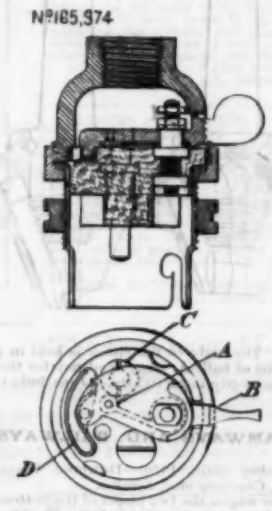


leading-in wires F F. The connections for the grid and anode are carried out to G and H respectively.—*June 30th*, 1921.

SWITCHGEAR.

165,374. December 3rd, 1920.—Key Lampholders, G. F. Oatins, 272-3, Hennage-street, Birmingham.

In this key lampholder the movable contact A is carried by an insulating lever B and completes the circuit to the lamp when it touches the resilient contact C. A spring D provides, in con-

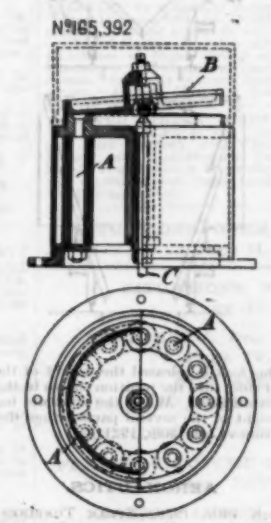


junction with an extension of the lever, for a snap action. The connection with the contact A is made through the pivot of the lever.—*June 30th*, 1921.

TRANSMISSION OF POWER.

165,392. January 21st, 1920.—Means for Transmitting Movements, H. J. Fereday, 22, Huron-road, Upper Tooting, London.

The inventor states that the object of his invention is to provide simple means by which mechanical movements can be produced, modified and transmitted in an efficient and simple

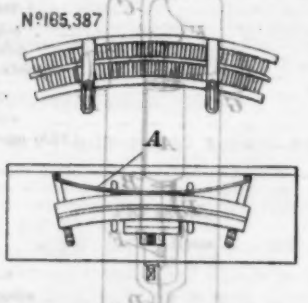


manner. A series of electro-magnets A A is arranged in a circle and the magnets are used, in turn, to attract the iron swash plate B, which imparts a rotary motion to the shaft C.—*June 21st*, 1921.

MACHINE TOOLS AND SHOP APPLIANCES.

165,387. December 13th, 1919.—Manufacturing Springs, H. Brockhouse, Lawnside, West Bromwich; H. W. Webster, 183, Cemetery-road, Sheffield; and Vickers Limited, River Don Works, Sheffield.

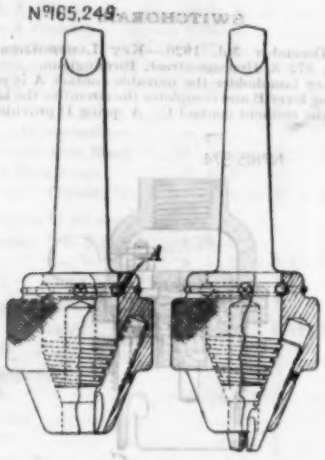
The inventors propose to form the leaves of laminated springs by bending the blanks in formers so contrived that the liquid used to quench them, in the process of tempering, has free access. At the same time one of the formers is supported by a spring,



so that it follows up the blank as it contracts on cooling. The upper illustration shows the formers comprised of a series of pegs, with their ends shaped to the desired form, while the lower view shows the following-up spring A.—*June 13th*, 1921.

165,249. April 9th, 1920.—Drill Chucks, B.S.A. Tools, Limited, and W. T. Brown, Armoury-road, Small Heath, Birmingham.

In this drill chuck the jaws are moved by being screwed in or out along a left-handed screw cut on the conical end of the

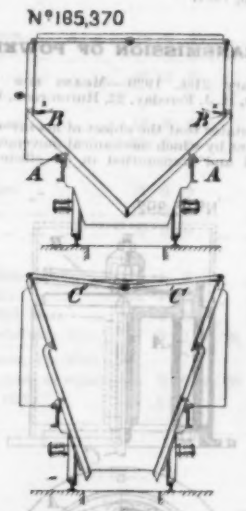


chuck spindle. The body of the chuck is held in place on the spindle by means of balls A. Any tendency for the drill to slip will make the jaws grip more tightly.—*June 30th*, 1921.

TRAMWAYS AND RAILWAYS.

165,370. October 25th, 1920.—Dumping Wagons, *T. W. Rogers*, 33, *Chancery-lane, London*.

In this hopper wagon the two pieces of the bottom are pivoted at A A and are hinged to the sides at B B. The tops of the sides are held in place by the links C C. When the wagon is to be loaded the lower edges of the two bottom pieces are locked

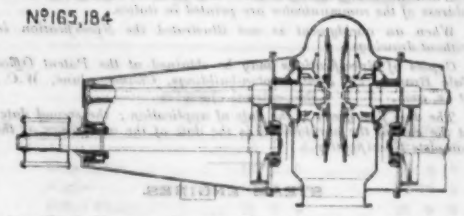


together. If this lock is released the weight of the load brings the bottom and sides into the position shown in the lower figure and the load is dumped. When the contents have been discharged the weight of the several parts brings them back into the closed position.—*June 30th*, 1921.

AERONAUTICS.

165,184. March 19th, 1920.—Steam Turbines for Aeroplanes, W. Chilton, The Cottage, Barrow-on-Soar, near Loughborough, and the Brush Electrical Engineering Company, Limited, Loughborough, Leicestershire.

In this specification a claim is made for "aircraft having as propelling means a steam turbine or turbines of the double rotation Ljungström type and adapted to drive one or a plurality of propellers adapted to act either as tractor or pusher or as both tractor and pusher in combination." The illustration reproduced shows the arrangement of the turbine and reduction gearing,

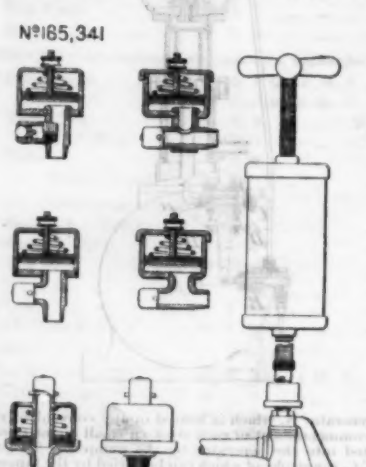


while a number of others, not reproduced here, indicate alternative arrangements of the propellers with regard to the body of the aeroplane.—*June 30th*, 1921.

MISCELLANEOUS.

165,341. July 8th, 1920.—Grease Cups, *A. E. White*, 88–90, *Chancery-lane, London, W.C.* 2.

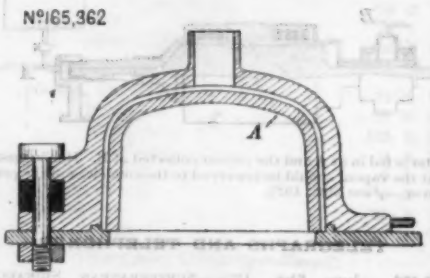
In this specification a claim is made for a system of lubricating in which the grease cups are so formed that a supply of grease can be forced into the bearing by means of a squirt and, at the



same time, the receptacle of the cup filled. The grease stored in the cup is fed to the bearing by the pressure of a spring after the squirt is removed. The drawings show alternative designs of grease cup, and the squirt in use.—*June 30th*, 1921.

165,362. September 20th, 1920.—Casting Aluminium, A. Riccio, Via Sella Polare, No. 80, Naples, Italy.

With the object of preventing hollow articles cast in aluminium being fractured as they cool down in the mould, the inventor



uses a hollow core A, made of ordinary foundry sand, about 10 mm. or 15 mm. thick, which collapses when the casting contracts. The exterior part of the mould is of cast iron.—*June 30th*, 1921.

A new edition—the second—of the Classification for Works on Pure and Applied Science in the Science Library at the Science Museum, South Kensington, has just been issued by the Board of Education. The decimal or Dewey system is employed. The volume, in a paper cover, costs 18s. net, and is to be obtained through any bookseller or from his Majesty's Stationery Office.

Boiler Economy.—We have received from the Fuel Economy Committee of the Federation of British Industries the first of its Fuel Economy Monographs, which is entitled "Practical Suggestions for the Economical Working of Boiler Plant," and is sold at 2s. 6d. net. If such a pamphlet is needed our regret is profound. There is not in it a single thing that anybody in charge of boilers has not known for the last fifty years or more and that all the best engineers and boilermen practised. We see only one item in which the older men would disagree with the Fuel Economy Committee. The Committee—it is writing of water-tube and Lancashire boilers—holds that fuel should be fired all over the fire and not on to the dead plate; the old masters fired on to the dead plate and so made sure of burning the volatiles in their passage over the glowing coals. Chain-grate stokers do the same thing automatically. We fail to see any reason for condemning the practice, provided it is not pushed to extremes. The great object should be to keep an even bed of fire. If there are holes, fill them up; if there are not, the dead plate is a good place for cold raw fuel. The real difference between the old firemen and those of to-day is that they knew by practice and observation, whereas men now depend upon instruments. There is a great deal to be said for the instruments, but they have not altered the principles of good firing; what they do is to help in the application of those principles. The principles are of such simplicity that they ought to be known to everyone having anything to do with boilers. That is why we regret that their enunciation now should be necessary.

Forthcoming Engagements.

TO-DAY.

The Junior Institution of Engineers.—39, Victoria-street, Westminster, S.W. 1. "Flax: Its Cultivation and Manufacture," by Mr. C. R. Turner. Slides and exhibits, 8 p.m.

SATURDAY, AUGUST 6th.

North of England Institute of Mining and Mechanical Engineers.—Wood Memorial Hall, Newcastle-on-Tyne. Annual General Meeting. Address by retiring President, Lieut.-Colonel F. R. Simpson. Paper: "The Carbonisation of Coal at Low Temperatures," by Mr. John Roberts. 2 p.m.

MONDAY TO SATURDAY, SEPTEMBER 5th TO 10th.

Iron and Steel Institute.—Autumn meeting in France.

WEDNESDAY, SEPTEMBER 7th TO 14th.

British Association.—Annual meeting in Edinburgh. For programme see page 154.

WEDNESDAY, THURSDAY AND FRIDAY, SEPTEMBER 21st, 22nd, AND 23rd.

The Institute of Metals.—Autumn meeting in Birmingham. For programme see page 151.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

A company, entitled Cie. Continentale des Foyers Turbine (Soc. An.), 29, Rue de l'Evêque, Bruxelles, was formed on June 25th, to exploit the turbine furnaces, of which the original was invented some four or five years ago by Mr. V. R. Chadwick, now the technical director to the Turbine Furnace Company, Limited, of 238B, Gray's Inn-road, W.C. 1. Mr. W. H. Badams, the managing director of the English company, has a seat on the board of the continental company, as representing the English interests. The managing director of the continental company is Lieut.-Colonel B. A. Thornton, and its board includes, amongst others, Compte Louis van der Burch, Compte de Pellan, and Monsieur D. Rom, representing the interests of Compte Horace van der Burch, one of the principal shareholders.

CATALOGUES.

Dieny and Lucas, 329, High Holborn, W.C. 1.—Pamphlet No. 9 gives particulars with illustrations of drives where "Adhex" belting has been used.

Simplex Conduits, Limited, Garrison-lane, Birmingham.—Revised edition of list No. 861, which deals with the Simplex colliery lighting system.

Hyatt, Limited, 4, Thurloe-place, South Kensington, S.W. 7.—Illustrated catalogue dealing with Hyatt roller bearings for elevators and conveyors.

George Ellison, Perry Barr, Birmingham.—Illustrated catalogue dealing with circuit breakers, alternating-current starting gear, and crane control gear.

General Electric Company, Limited, Magnet House, Kingsway, W.C. 2.—Illustrated guide which tells you how to get to Magnet House from anywhere in London and district.

Daniel Adamson and Co., Limited, Dukinfield, Manchester.—Pamphlet dealing with the history of the above-named firm under the title "The House of Adamson." Power plant for every requirement is mentioned.

Joseph Wright and Co., Limited, Tipton, Staffs.—Illustrated catalogue of chains, slings, cables, anchors, shipping tackle, pulley blocks, moorings, anvils, &c., also a sling working-load table.

Turton Bros. and Matthews, Limited, Sheffield.—Illustrated catalogue dealing with high-speed twist drills, helical volute and conical springs, shear blades, dies and punches, &c. Prices of the different articles are included.

Clayton and Shuttleworth, Limited, Stamp End Works, Lincoln.—Illustrated catalogue which deals with crude oil engines. In addition to the tone reproductions, line blocks showing sections of the engines are included.

Francis Shaw and Co., Limited, Bradford, Manchester.—Profusely illustrated catalogue dealing with rubber and allied trades machinery. All the latest and most up-to-date improvements are included in Messrs. Shaw's machines.

Butler Machine Tool Company, Limited, Victoria Ironworks, Halifax.—Sheet No. 2B deals with the "Butler" tool-room shaper, which Messrs. Butler claim to be the quickest acting shaper on the market, and is essentially designed for precision work.

F. W. Brackett and Co., Limited, Hythe Bridge Ironworks, Colchester.—Illustrated catalogue dealing with the firm's well-known air compressors. Many sectional diagrams have been included in this edition, whilst the binding is in stiff boards and linen back, thereby giving longer life to the catalogue.

Kilmarnock Engineering Company, Limited, Britannia Works, Kilmarnock.—Leaflet No. 1 deals with light railway material. Illustrations of locomotives, rails, points, crossings, and turntables, &c., are given. Wagons and electric locomotives are illustrated, and the firm also supplies electric haulers and winders.

Scholey and Co., Limited, 56, Victoria-street, S.W. 1.—Illustrated pamphlet M2, dealing with Scholey fractional H.P. motors, which can be supplied at the present time. Prices are given. Also an illustrated pamphlet which deals with the "Croydon" electric sucker and blower. A few of the uses to which it may be put are illustrated.

Hollings and Guest, Limited, Thimble Mill-lane, Birmingham, have sent us a pamphlet describing their new hydraulic tire press. This press is formed with an open slot in the head in order that the tires may be fixed to or removed from Foden or similar wheels without taking the wheels off their axles. The press is made in two sizes, namely, of 154 and 200 tons total pressure.

The British Industries Fair, 1922.—From a copy of the prospectus of the British Industries Fair (Birmingham), 1922, which has just reached us, it appears that the schedule of exhibits has been considerably widened, and that new groups are included for the following trades:—Construction building and decoration; agricultural; mining; brewing, distilling and catering; and services. In addition, the existing groups of metals, power, lighting and heating, engineering, and hardware, brassfoundry and ironmongery have been enlarged with a view to making them thoroughly comprehensive of the manufactures embraced by the respective titles. It is announced that an encouraging response has been received to the first issue of the prospectus, and that, in addition to the many renewals of applications for space by firms which have previously exhibited at the Fairs, an appreciable number of new entries has already been received.